



Asset Liability Management Workshop

November 8 – 9, 2010 | Room 1140



CalPERS

Investment Office



BOARD OF ADMINISTRATION

INVESTMENT COMMITTEE

Asset Liability Management (ALM) Workshop

November 8-9, 2010

8:30 a.m.

Lincoln Plaza North
400 Q Street, Room 1140
Sacramento, CA

Monday, November 8, 2010

Time	Subject	Presenter(s)
8:30 am	Overview	Joseph Dear Chief Investment Officer, CalPERS
8:45 am	ALM – Objectives and Review	Farouki Majeed Senior Investment Officer, CalPERS Allan Emkin Pension Consulting Alliance (PCA) Michael Schlachter Andrew Junkin Wilshire Consulting
10:15 am	Break	
10:30 am	Economic Scenarios and Asset Returns	Farouki Majeed Lorne Johnson Portfolio Manager, CalPERS
11:15 am	Asset Class Roles and Outlook <ul style="list-style-type: none">• Asset Classification – Current vs. Alternative• Panel Discussion	Farouki Majeed CalPERS Senior Investment Staff: Joseph Dear Eric Baggesen Ted Eliopoulos Curtis Ishii Farouki Majeed Joncarlo Mark

ALM Workshop

Monday, November 8, 2010 (continued)

Time	Subject	Presenter(s)
12:00 pm	Lunch	
1:00 pm	Committee Decision on Alternative Asset Classification	Committee Members
1:30 pm	Liabilities	Alan Milligan Chief Actuary, CalPERS
2:15 pm	Break	
2:30 pm	Decision Factors: How portfolio choice impacts contribution rates and fund status	Robert T. McCrory EFI Actuaries Richard Roth Senior Portfolio Manager, CalPERS
3:15 pm	Portfolio Selection Criteria – Preview	Richard Roth
4:00 pm	End of Session	

Tuesday, November 9, 2010

8:30 am	Overview of Day Two	Joseph Dear
8:45 am	Candidate Portfolios, Risk / Return Characteristics and Portfolio Attributes	Farouki Majeed Raymond Venner Portfolio Manager, CalPERS
10:00 am	Break	
10:15 am	Portfolio Selection by Committee	Farouki Majeed Richard Roth Jay Jeong Investment Officer, CalPERS
11:45 am	Recap / Next Steps	Joseph Dear
12:00 pm	End of Session	

Asset Liability Management Workshop

November 8, 2010

Overview

Day 1

Joseph Dear
Chief Investment Officer,
CalPERS

Capital Allocation 2010-11 Timeline

Strategic Asset Allocation & Asset Liability Management Review



Agenda for Today

- Objectives and Review
- Economic Scenarios and Asset Returns
- Asset Class Roles and Outlook
 - Asset Classification – Current vs. Alternative
 - Panel Discussion
- *Committee Decision on Alternative Asset Classification*
- Liabilities
- Decision Factors: How portfolio choice impacts contribution rates and fund status
- Portfolio Selection Criteria - Preview

ALM Objectives and Review

Farouki Majeed
Senior Investment Officer,
CalPERS

November 8, 2010

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Objectives of 2010 ALM Workshop

- Decision on Alternative asset classification (Day One)
- Select a policy portfolio from among alternatives with an *acceptable level of risk* to attain long term funding goals (Day Two)

Objectives of 2010 ALM Workshop

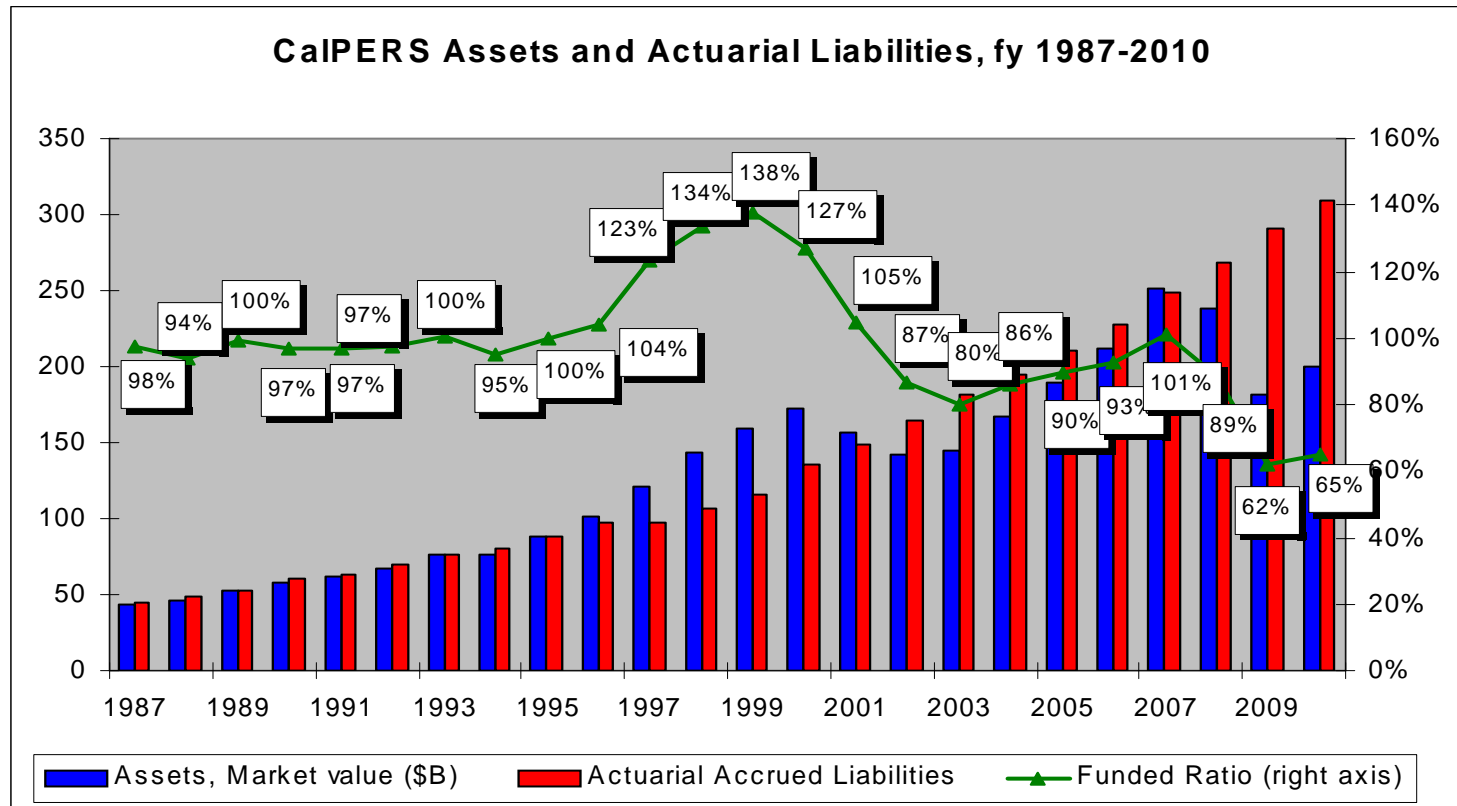
Next Steps

- Committee approves final Policy Portfolio and ranges in December 2010
- Set an Active Risk Budget (guidelines) for implementation of the Policy Portfolio by staff. This will be addressed through the Asset Allocation Policy in Q1 2011
- Review and set discount rate: February 2011

ALM Objectives

- Improve funding over the long term
- Minimize surplus (gap between assets and liabilities) volatility
- Stabilize contribution rates
- These objectives are framed into the decision factors for portfolio selection
- Caveat: Long term smoothing tends to reduce the impact of liabilities on asset allocation framework

Objectives - CalPERS Funded Ratio



Liabilities growing at 8.5% annually since 2000

ALM Approaches

- Liability Matching Portfolio
 - Proxy 30% Nominal Govt. Bonds (Long Treasuries) and 70% Inflation-Linked Bonds (TIPs)
 - Expected returns much lower than current assumed rate - unrealistic contribution increases to meet funding goals
- Return Seeking Portfolio
 - Equity centric portfolio although diversified among risky assets
 - Higher expected return improves funding prospects but downside funding risk is significant
 - Most US public funds use this approach since the 1990s
- Mix of Liability Matching and Return Seeking Portfolio
 - This portfolio would be more liability aware with appropriate target allocations to long term Treasuries and TIPs
 - Higher contributions if implemented at this stage

ALM Approaches

- Current funded ratio of around 65% makes option one and three unrealistic for CalPERS due to higher contribution rates at this time.
- The way forward may be to consider option three on a gradual basis as funding ratio improves.
- The Proposed Asset Classification would make it easier for this approach to be implemented in the future.

Role of Asset Allocation

Asset Allocation is the principal determinant of the long term performance

- Asset Allocation Policy explained 90% of the variability of actual returns of a fund over time. (*Brinson; Ibbotson*)
- Asset Allocation Policy explained about 40% of the return difference among funds. (*Ibbotson*)
- Asset Allocation Policy explains about 100% of the level of return across funds. (*Ibbotson*)

CalPERS experience is similar to conclusions one and three above

Sources

Gary P. Brinson; Brian D. Singer; and Gilbert L. Beebower; “Determinants of Portfolio Performance; An Update”; Financial Analysts Journal May-June 1991.

Ibbotson and Kaplan, Does Asset Allocation Policy Explain 40, 90, or 100 Percent Performance?; Financial Analyst’s Journal January/February 2007 (see appendix)

Historical Asset Allocation Policies

CLASSIFICATION		1993	1995	1997	2000		2002	2004		2008	2009
CASH		2%	2%	1%	0%		0%	0%		0%	2%
FIXED INCOME	Domestic	37	24	24	24		–	–		–	–
	International	4	4	4	4	Global	26	26		19	22
TOTAL FIXED INCOME		41	28	28	28		26	26		19	22
EQUITIES	Domestic	33	38	41	39		39	40		–	–
	International	12	20	20	19		19	20	Global	56	49
	AIM	4	5	4	6		7	6		10	14
TOTAL EQUITIES		49	63	65	64		65	66		66	63
REAL ESTATE		8	7	6	8		9	8		10	10
INFLATION-LINKED ASSETS (ILAC)		–	–	–	–		–	–		5	5
TOTAL		100%	100%	100%	100%		100%	100%		100%	100%

2007 Changes to Asset Allocation

- Single Global Equity Asset Class combining Domestic and International Equity with market capitalization weighting (US weight down from 66% to 45%)
- Introduction of Inflation-Linked Asset Class
 - Inflation-Linked bonds
 - Commodities
 - Infrastructure
 - Forestland
- Risk level similar to prior policy portfolio

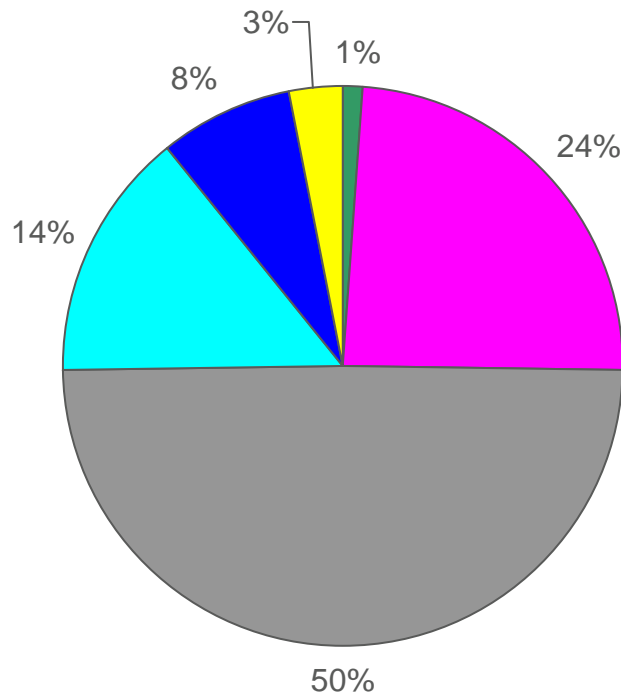
Proposed Change in 2010

Alternative Asset Classification

- Three main risk buckets
 - Growth: Global Equities, Private Equity (AIM)
 - Inflation: Inflation-Linked Bonds (ILBs), Commodities
 - Nominal Government Bonds: Liquidity – Interest rates
- Two additional classes
 - Real: Real Estate, Infrastructure, Forestland
 - Income: Global Fixed Income

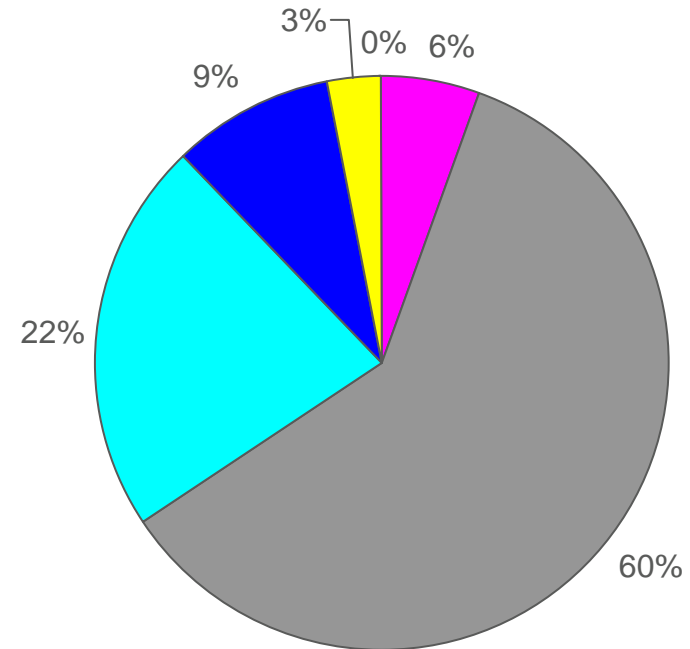
Asset Allocation vs. Risk Allocation – RMS Forecast August 2010

Asset Allocation



■ Cash ■ Global Fixed Income ■ Global Equities ■ AIM ■ RE ■ ILAC

Risk Contributions



■ Cash ■ Global Fixed Income ■ Global Equities ■ AIM ■ RE ■ ILAC

Lessons Learned from the Global Financial Crisis

"Life can only be understood backwards; but it must be lived forwards."

Soren Kierkegaard – Danish Philosopher

Lessons Learned from the Global Financial Crisis

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*"I was spreading some risk around, and apparently
it all wound up in your portfolio."*

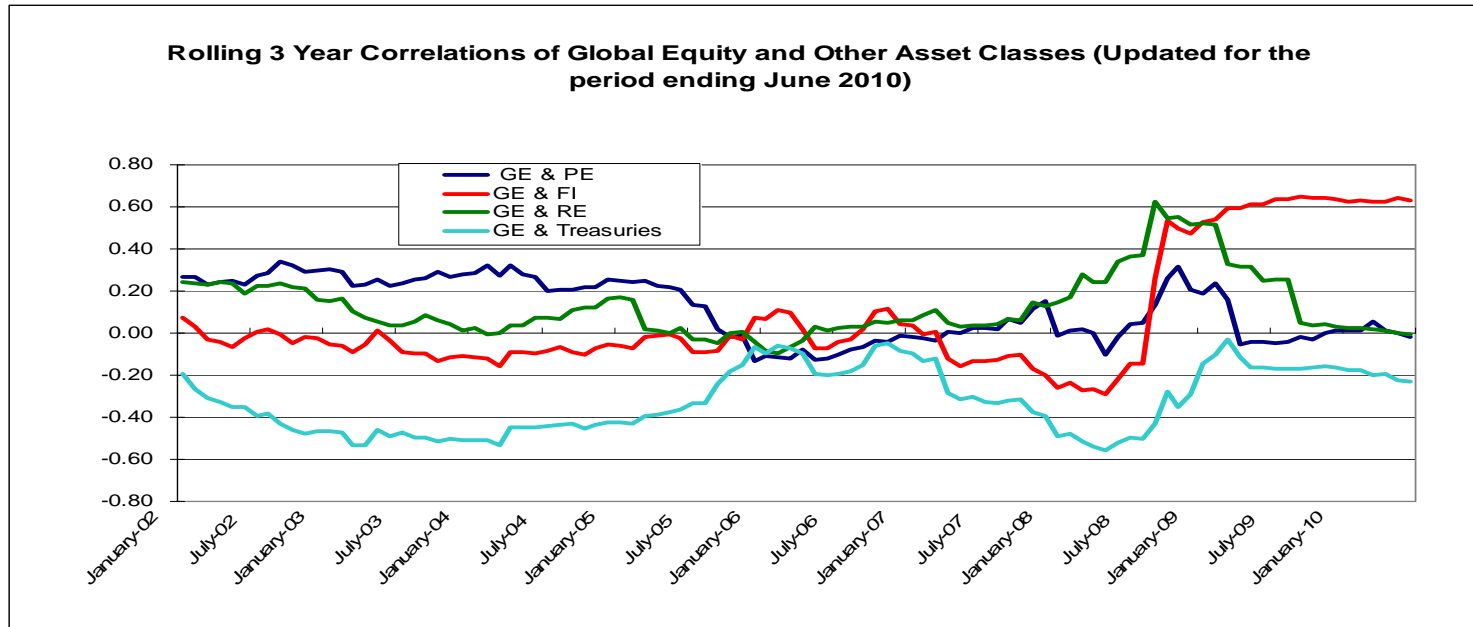
Lessons Learned from the Global Financial Crisis

- High equity risk in the portfolio (85% of total risk) led to significant drawdown (37%) and reduction in funded status
- Risk to the pension deal due to societal and regulatory pressures
- Conventional asset diversification broke down as correlations tended to one (1.0) – genuine diversification by risks is needed
- No strategic allocation to Nominal Govt. Bonds (US Treasuries) which was an effective hedge against market risks - flight to quality
- Normal risk return relationships were reversed with risky assets (Equities, Private Equity, Real Estate) underperforming less risky assets (Bonds)
- Over-reliance on quantitative models – false precision

Lessons Learned from the Global Financial Crisis

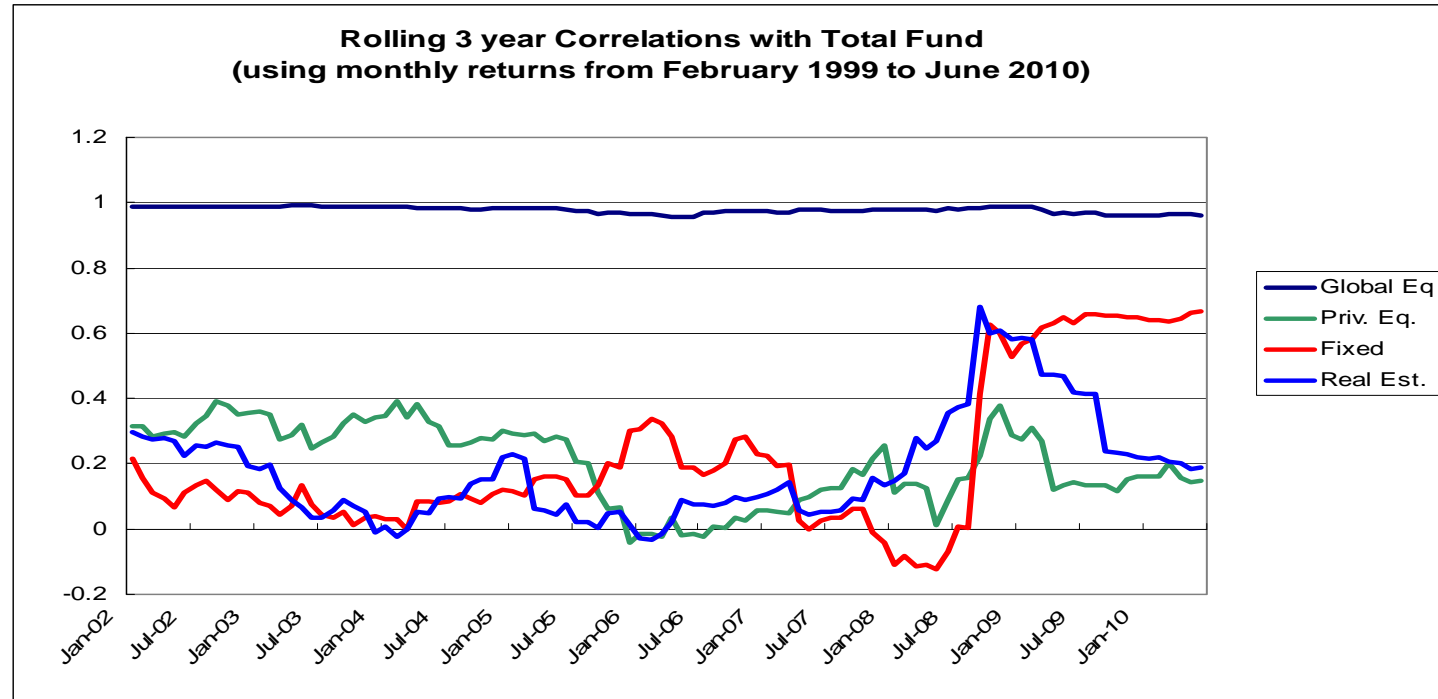
- Liquidity squeeze caused by credit market freeze in reinvestment portfolio and high levels of unfunded commitments in private assets
- Leveraged investments required additional equity contributions as market value of assets declined liquidity demands
- AIM allocations dragged up by denominator effect – target adjusted up from 10% to 14% in 2009 interim review
- Managing to target allocations in Private Assets (AIM, Real Estate) results in increasing commitments at market peaks and vice versa – contrary to valuation fundamentals
- Cash allocation reinstituted in 2009 with 2% target and range of 0-5% to address liquidity issues
- Leverage/liquidity risks addressed through fund-wide Leverage Policy with lower limits, monitoring and reporting to Investment Committee

Correlations with Global Equity



		GE & PE	GE & FI	GE & RE
Average	Entire Period	0.11	0.07	0.13
	Before Oct. 08	0.13	-0.06	0.10
	After Oct. 08	0.06	0.60	0.22

Correlations with Total Fund



Average	Global Eq	Priv. Eq.	Fixed	Real Est.
	0.98	0.20	0.21	0.18

CalPERS – Actual Risk/Return

**Asset Class Net Nominal Risk and Return
10yrs ended August 2010**

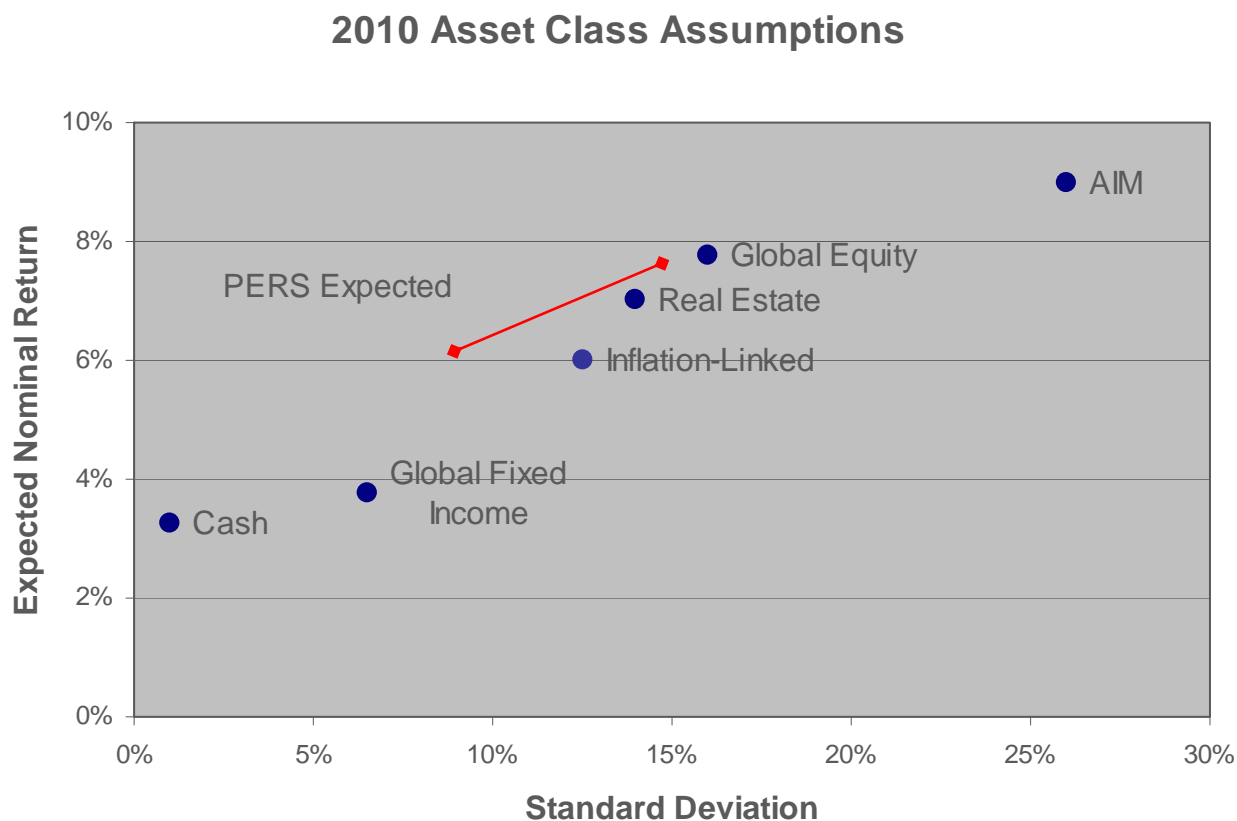


CalPERS – Actual Risk/Return

**Asset Class Net Nominal Risk and Return
5yrs ended August 2010**



CalPERS – Forecast Risk/Return



Risks to the Forecast

- Forecasting returns is not an exact science; lacks predictive power and could be subject to significant error.
- Return assumptions assume a return to a normal economic environment with steady trend growth, moderate inflation and stable interest rates.
- The US economic environment is currently “unusually uncertain” – following the global financial crisis and great recession of 2008/2009.

PLAUSIBLE ECONOMIC SCENARIOS	PROBABILITY
Japan-like Deflation / No Growth	?
Stagflation / Low Growth / High Inflation	?
Low Growth / Low Inflation	?
Steady Growth / Return to Normal	?

- High probabilities for scenarios one through three could result in significantly lower than expected returns.

Initial Conditions Affect Subsequent Returns

	12/31/1979	12/31/1989	12/31/1999	12/31/2009
P/E (S&P 500)	7.43	14.71	33.29	21.9
Dividend Yield (S&P 500)	5.55%	3.31%	1.15%	2.01%
10-year Treasury Yield	10.39%	7.84%	6.28%	3.26%
CPI (subsequent 10 yr period)	5.1%	2.9%	2.6%	?
Real GDP growth (subsequent 10 yr period)	3.0%	3.1%	1.8%	?
S&P 500 returns (subsequent 10 yr period)	17.4%	18.1%	-1.0%	?

- Decade of 1980s and 1990s produced higher than average equity returns as P/E multiples expanded from low levels, yields contracted from high levels; interest rates and inflation declined.
- Decade of 2000s has produced negative equity returns as P/E has contracted from a high level.

PROPOSED ALTERNATIVE ASSET CLASSIFICATION

Broad Classification	Consists of	Purpose
Liquidity/Hedge	Cash Nominal Government Bonds	Hedge equity and deflation risks, provide liquidity - negative correlation with equities
Growth	Public Equity Private Equity	Positive exposure to economic growth - equity risk premium
Income	Global Fixed Income	Provide income return
Real	Real Estate Infrastructure Forestland	Provide long horizon income return that is less sensitive to inflation risk
Inflation-Linked	Commodities Inflation-Linked Bonds	Public market investments with positive inflation exposure

Risk Diversification – Economic Regimes

	Growth	Inflation
Rising	<ul style="list-style-type: none"> Public Equities Private Equities Real Estate/REITS Commodities High Yield Corporate Spreads 	<ul style="list-style-type: none"> Commodities Inflation Linked Bonds
Falling	<ul style="list-style-type: none"> Nominal Government Bonds Inflation-Linked Bonds 	<ul style="list-style-type: none"> Public Equities Private Equities Real Estate/REITS Corporate Spreads Nominal Government Bonds

Rationale for Alternative Classification

- Attempts to group assets according to fundamental macro risks and return drivers (Economic Growth, Inflation, Interest Rates)
- Creates a framework for diversification across macro risks and economic regimes
- Creates a framework for hedging portfolios (Liability and Inflation)
- Creates a framework for dynamic strategic allocation (annual review) as opposed to long-term static policy allocations
- Will enable levered bond strategy should that be considered

CalPERS Cash Flow and Yield

Fiscal year end	Total Contributions	Benefit Payments	Expenses	Subtotal Cash Flow	Investment Income	Total Cash Flow	Inv. Income Yield
2002	2.85	-6.43	-0.21	-3.79	5.50	1.71	3.7%
2003	3.70	-6.99	-0.21	-3.50	4.86	1.36	3.4%
2004	6.38	-7.64	-0.19	-1.45	5.79	4.34	3.7%
2005	8.80	-8.43	-0.21	0.16	5.88	6.04	3.3%
2006	9.01	-9.24	-0.25	-0.48	5.42	4.94	2.7%
2007	9.52	-10.07	-0.28	-0.83	5.07	4.24	2.2%
2008	10.06	-10.84	-0.40	-1.18	1.89	0.71	0.8%
2009	10.61	-11.83	-0.43	-1.65	-0.45	-2.10	-0.2%
2010	10.40	-13.14	-0.38	-3.12	4.20	1.08	2.0%

source through 2009: Comprehensive Annual Financial Reports

2010 Inv. Income assumes 2% yield.; Fiscal provided other 2010 values

Conclusion - Multiple Considerations

- Board's Risk tolerance
- Capacity to take risk could come down with aging
- Expected returns
- Risks to the forecast: Economic Scenarios
- Fundamental macro risks: Alternative Asset Classification
- Liquidity: size of private assets, unfunded commitments, leverage
- Income: cover growing cash flow deficit

Conclusion - Choices

- Select Alternative Asset Classification or stay with current asset classes
- Portfolio choice: Committee risk tolerance

"The essence of investment management is the management of risks and not the management of returns."

Benjamin Graham



Asset Liability Management (ALM) Workshop

ALM Workshop Introductory Comments

November 2010

by

Pension Consulting Alliance, Inc.

Goal of the Asset/Liability Study:

To review and possibly modify the CalPERS strategic investment allocation policy, considering liabilities of the System and reflecting the unique definition and tolerance for risk as defined by the CalPERS Investment Committee.

Today's Goal:

To adopt an allocation framework that the Investment Committee believes will best address the key investment issues and risks.

A Brief Review of Asset/Liability Concepts

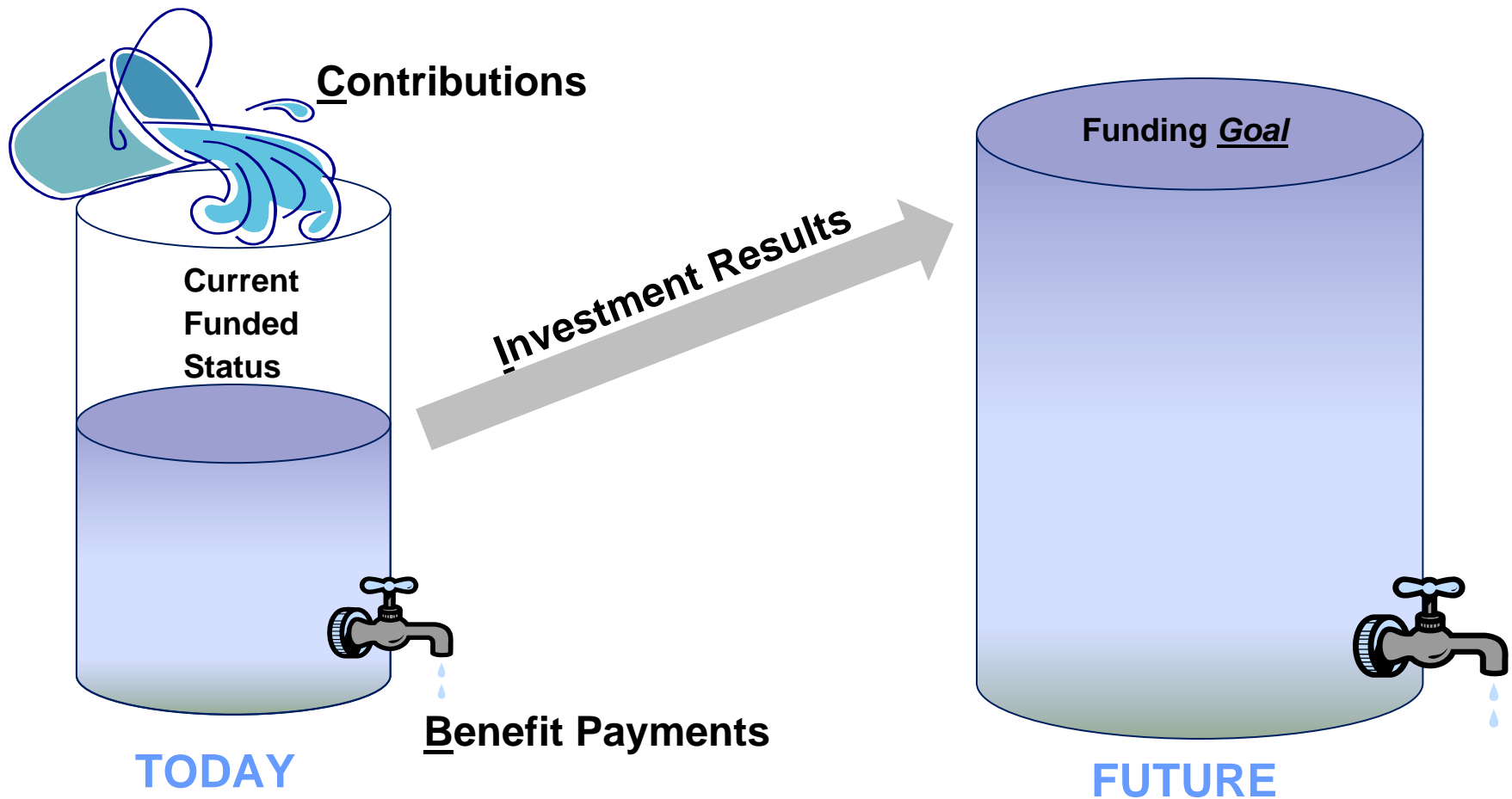
A Brief Review of Asset/Liability Concepts

An asset/liability study seeks to address the full *financial condition* of the System and how it might be impacted by investment results

“Financial condition” (i.e., linkages between assets and liabilities) can be examined by:

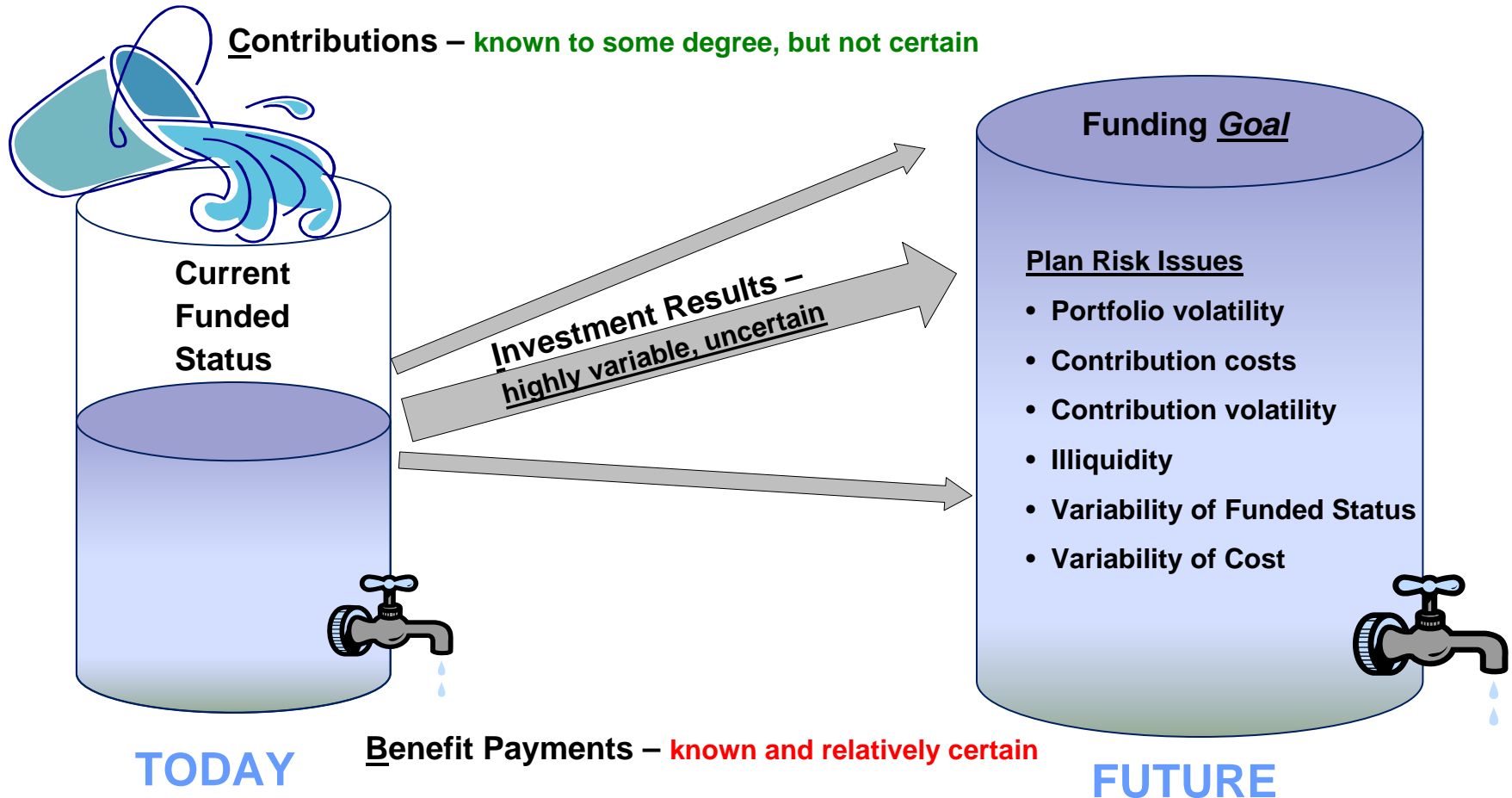
1. Projected funded status
2. Likelihood of deterioration in funded status
3. Projected cost
4. Likelihood of unacceptably high costs
5. Other pertinent issues

A Brief Review of Asset/Liability Concepts



$$C + I = B$$

A Brief Review of Asset/Liability Concepts



Today's Focus: Select the Allocation Framework

- Investment Allocation Framework Choices:

- Asset Oriented (current)

- Public Equity
 - Private Equity (AIM)
 - Fixed Income
 - Real Estate
 - Inflation Linked (ILAC)
 - Cash

- Risk Oriented (proposed)

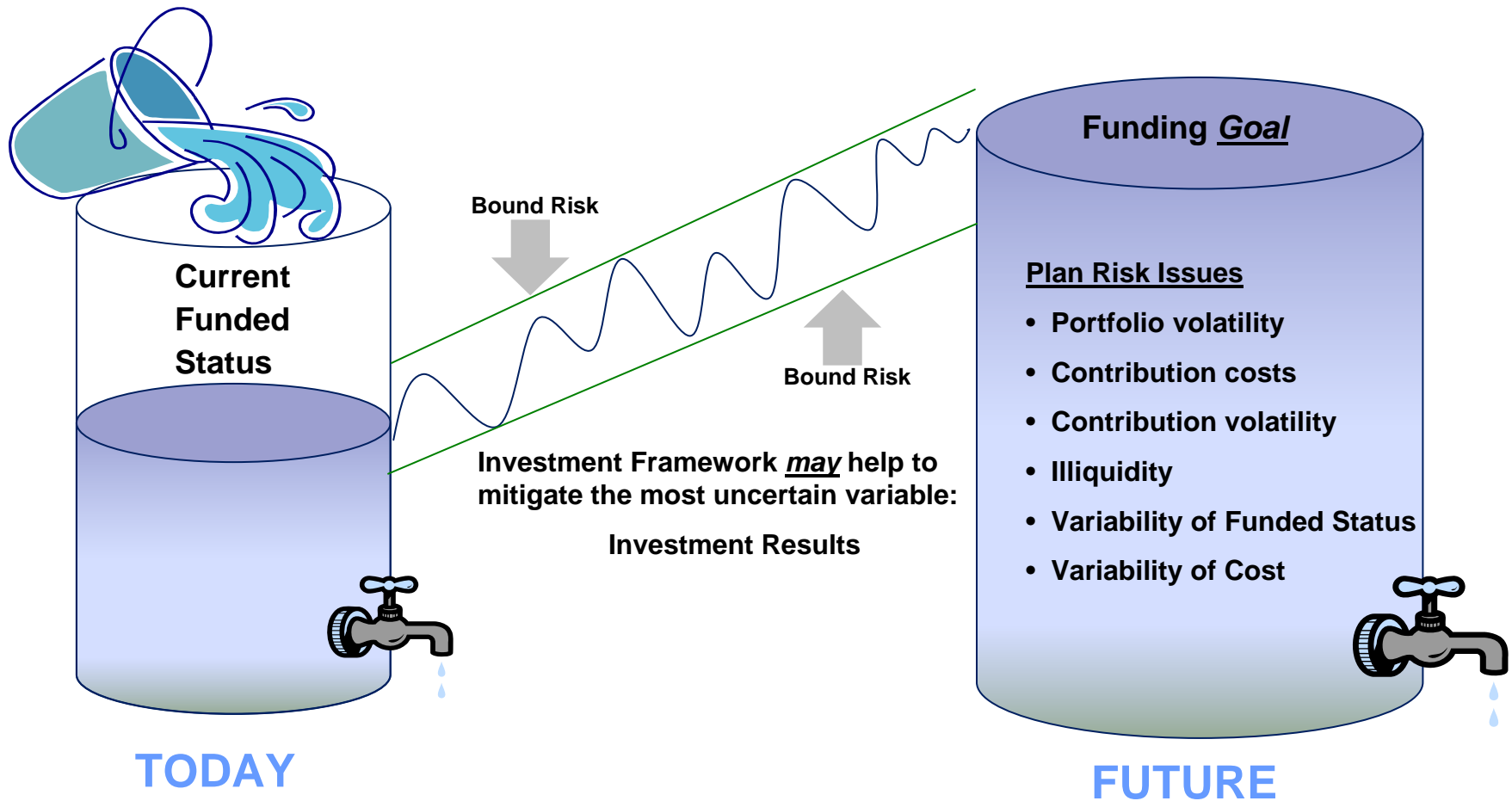
- Growth
 - Income
 - Real Assets
 - Inflation-oriented
 - Liquidity

- Investment Committee's Task for Today – Choose a framework
- Consultants' Role – Assist the Committee in making the choice

Today's Focus: Select the Allocation Framework

- Reasons for examining the allocation framework:
 - Certain risks can infect many asset classes at the same time
 - In light of a *more complex* investment world, keep key strategy decisions focused
 - In light of a *more volatile* investment world, a risk management orientation may prove better at helping to preserve long-term value

Potential Impact of Investment Framework





CalPERS Asset Allocation Workshop

Michael C. Schlachter, CFA
Managing Director & Principal

Andrew Junkin, CFA, CAIA
Managing Director & Principal

November 8-9, 2010

CalPERS Asset Allocation History

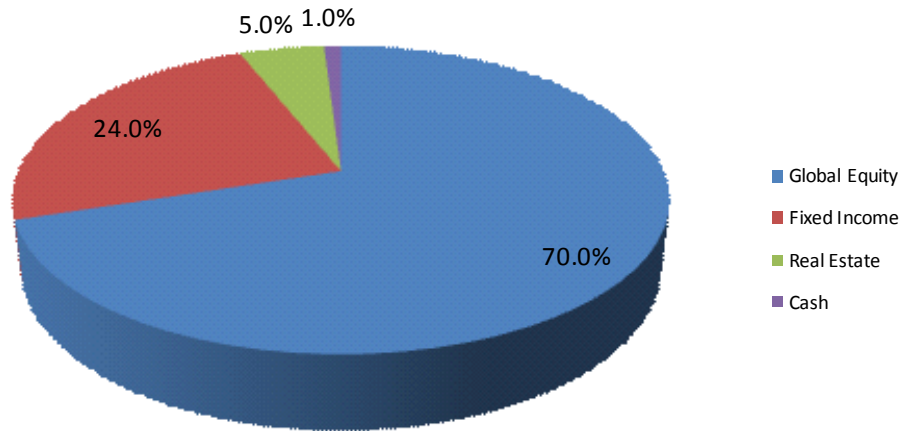
CalPERS Total Fund – Asset Allocation

	<u>1999</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>
% Equity	70	64	63	57	63	63	62	63
% AIM	-	-	-	5	5	5	5	6
% Fixed Income	24	29	27	28	24	24	25	23
% ILAC	-	-	-	-	-	-	-	-
% Real Estate	5	6	9	9	7	6	5	8
% Cash	1	1	1	1	1	1	3	1

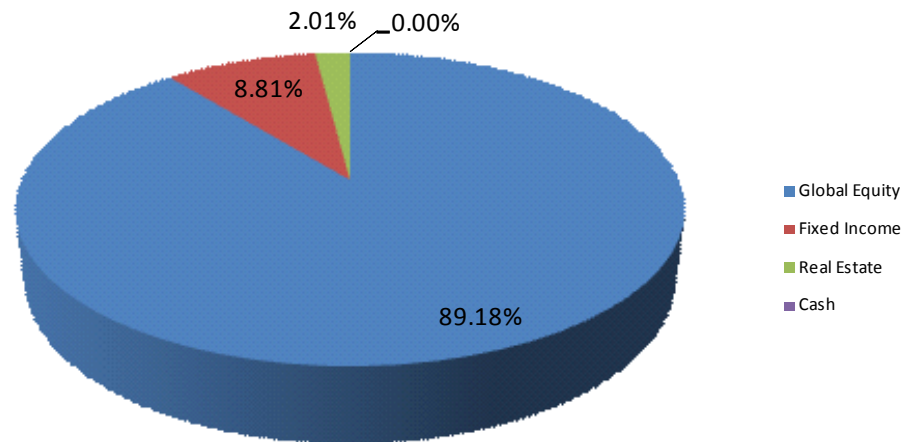
	<u>2007</u>	<u>2008</u>	<u>1Q09</u>	<u>2Q09</u>	<u>3Q09</u>	<u>4Q09</u>	<u>1Q10</u>	<u>2Q10</u>
% Equity	56	50	38	50	54	54	54	50
% AIM	8	12	14	11	11	12	13	14
% Fixed Income	27	24	26	25	24	24	23	24
% ILAC	1	2	3	3	2	2	2	2
% Real Estate	8	10	12	10	7	7	7	8
% Cash	1	1	8	1	1	1	1	2

12/31/1999 – 70% Equities, No AIM

Actual Asset Allocation



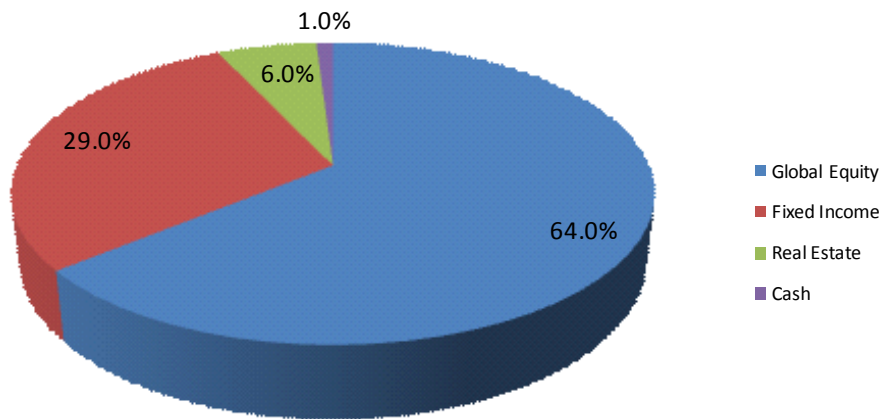
Contribution to Total Risk - Actual Allocation



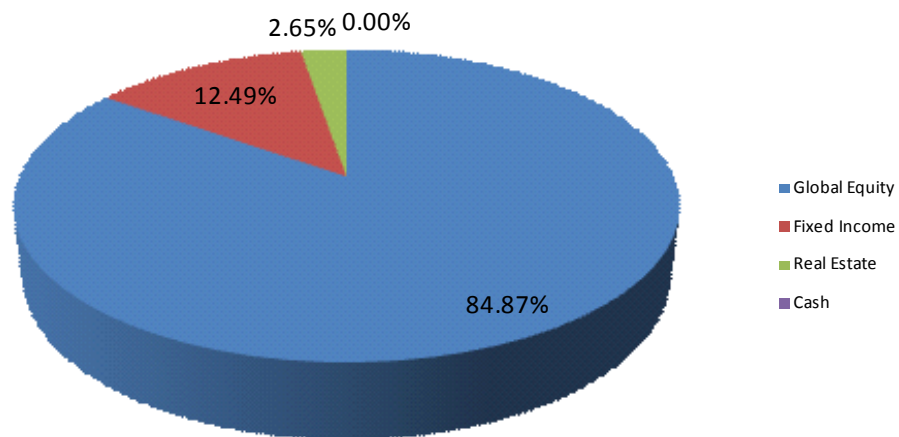
91% of risk from
“Growth Bucket”

12/31/2000 – 6% Shift from Equities to Fixed Income

Actual Asset Allocation



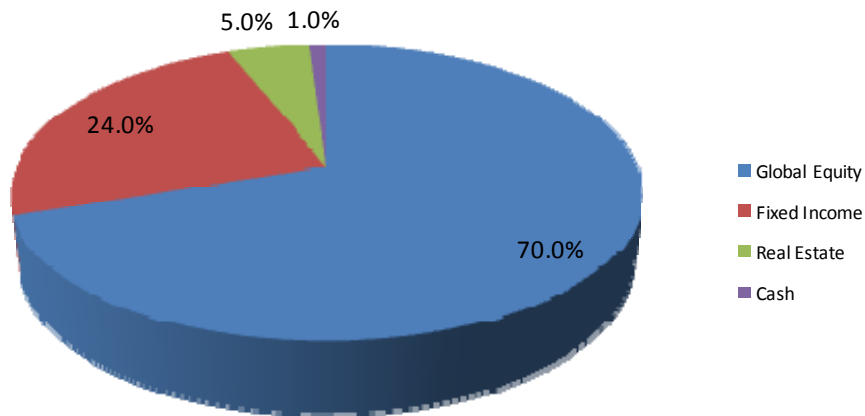
Contribution to Total Risk - Actual Allocation



87.5% of risk from
“Growth Bucket”

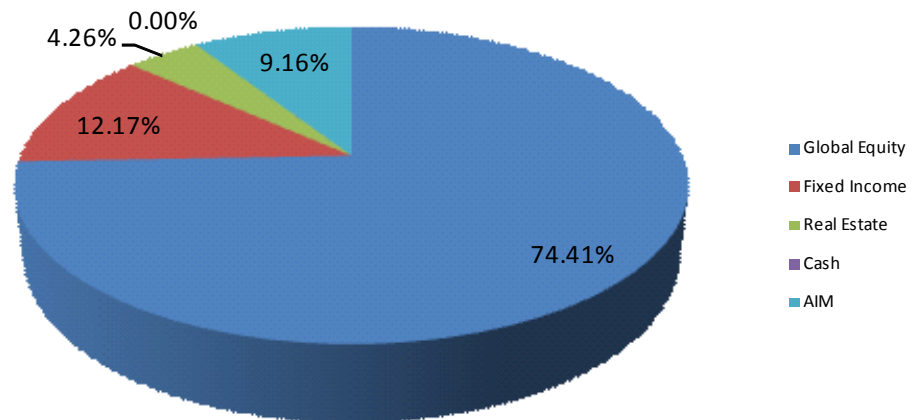
12/31/2002 – AIM Added, Equities Reduced 7%

Actual Asset Allocation



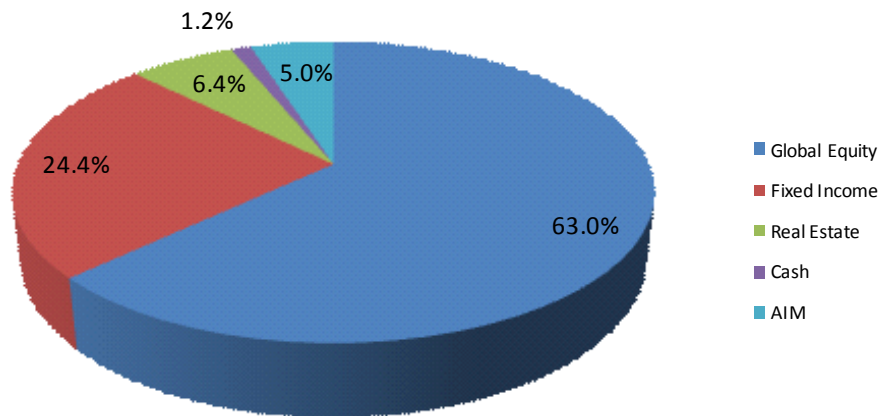
88% of risk from
“Growth Bucket”

Contribution to Total Risk - Actual Allocation

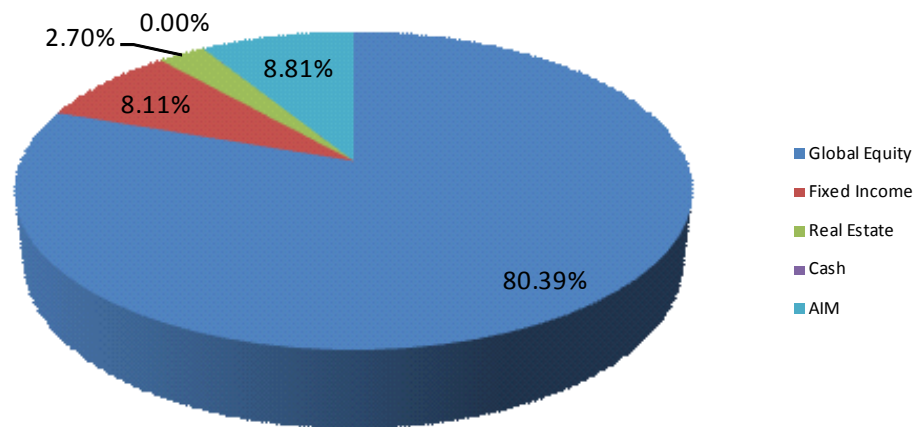


12/31/2004 – Equities Back up 6%

Actual Asset Allocation



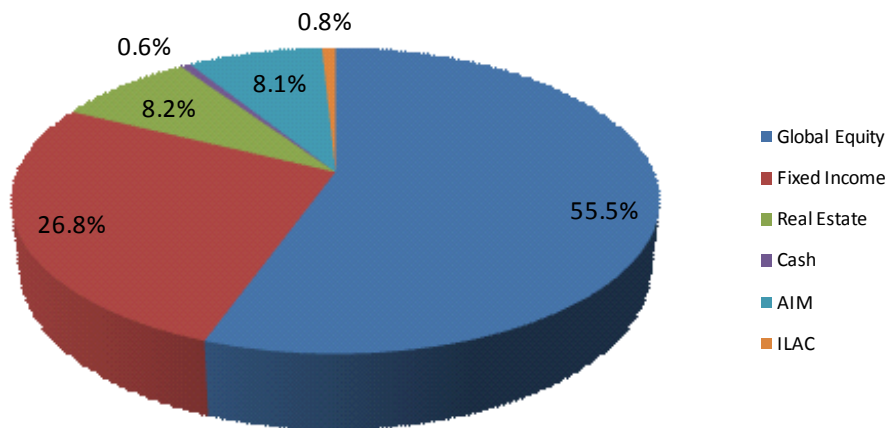
Contribution to Total Risk - Actual Allocation



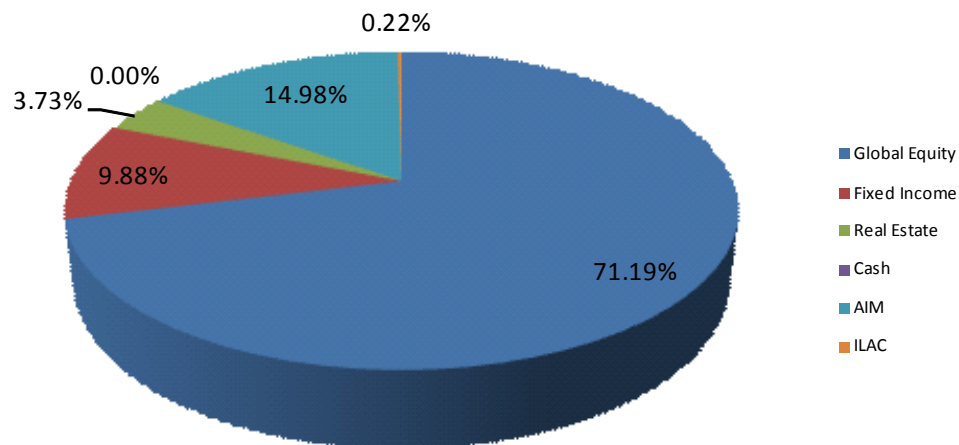
92% of risk from
“Growth Bucket”

12/31/2007 – AIM Growing, ILAC Added

Actual Asset Allocation



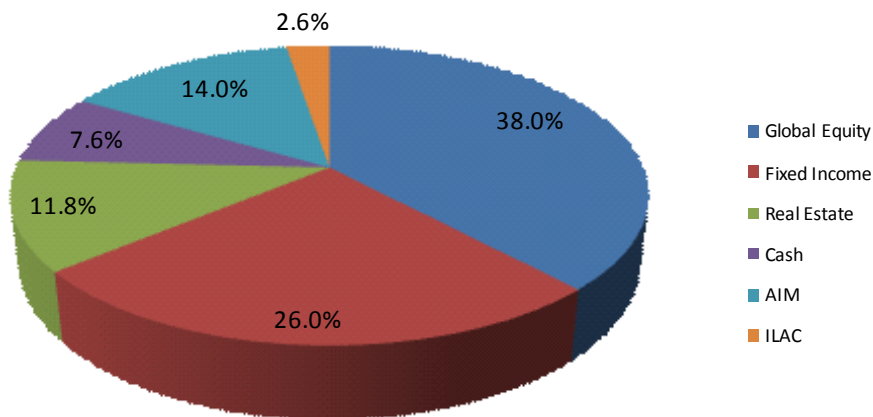
Contribution to Total Risk - Actual Allocation



90% of risk from
"Growth Bucket"

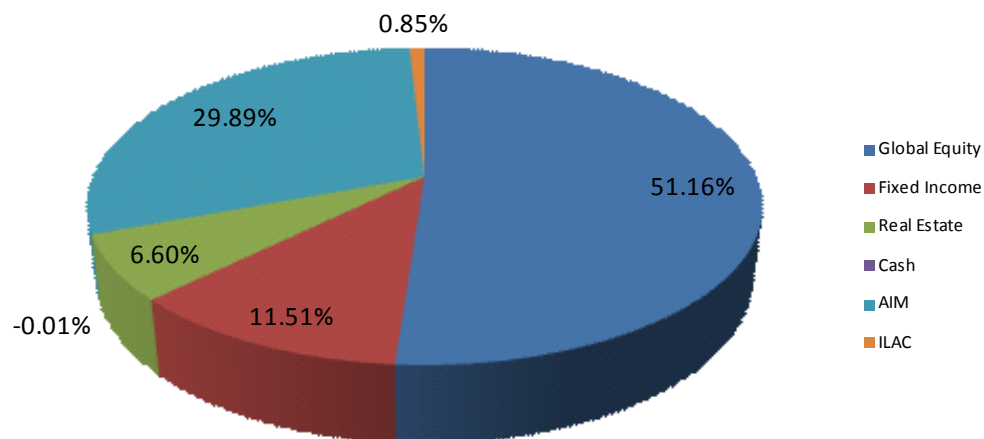
3/31/2009 – AIM at 14%, Cash at 8%, GE at 38%

Actual Asset Allocation



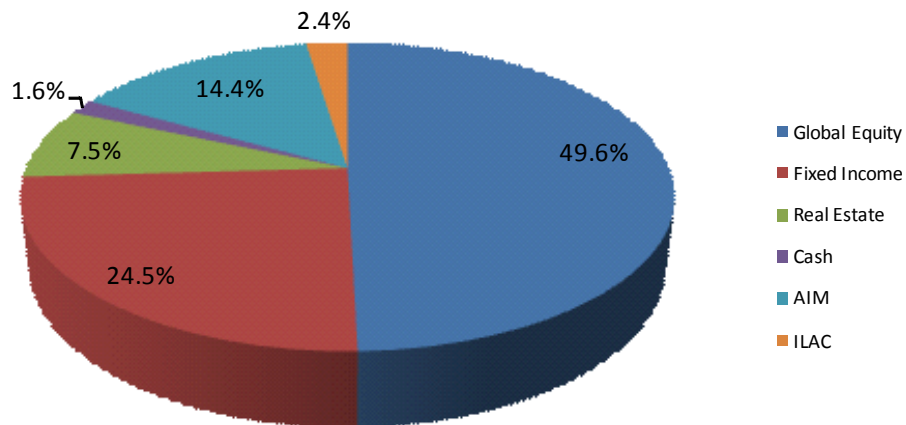
87.5% of risk from
“Growth Bucket”

Contribution to Total Risk - Actual Allocation

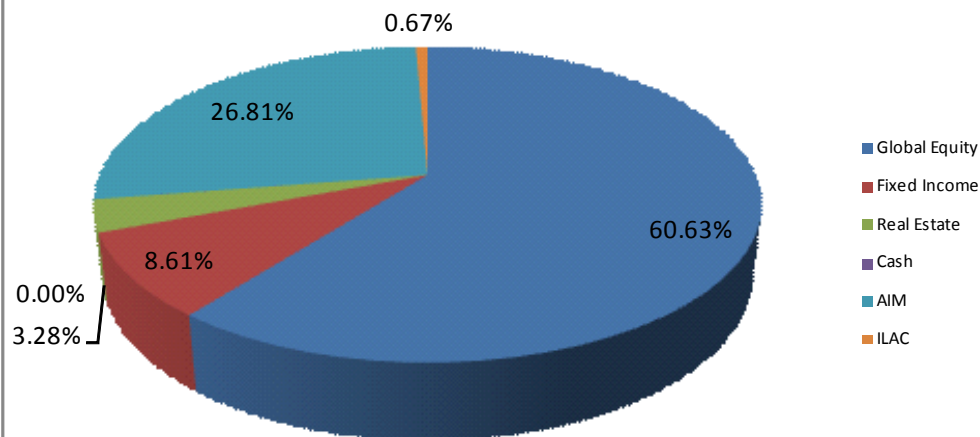


6/30/2010 – Equities Back to 50%, AIM 14%

Actual Asset Allocation



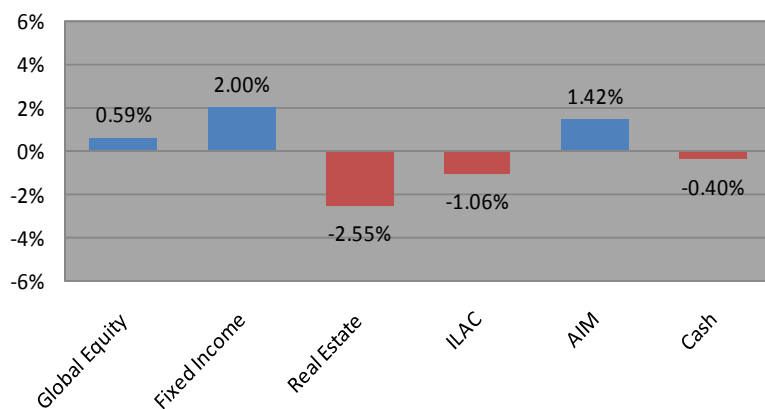
Contribution to Total Risk - Actual Allocation



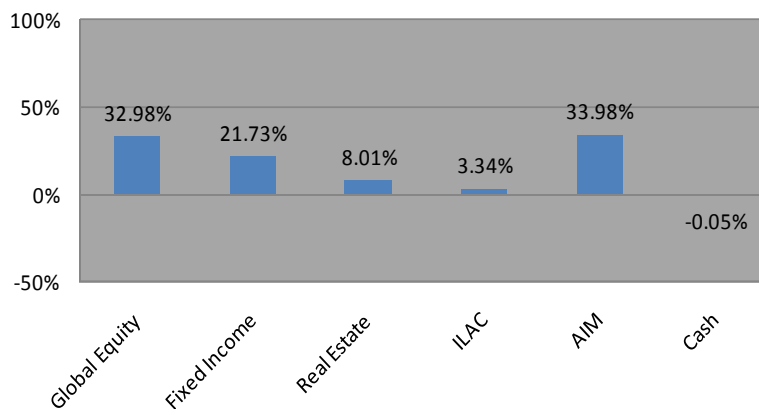
90.5% of risk from
“Growth Bucket”

Drivers of Expected Tracking Error (June 30, 2010)

PERS Asset Allocation Variance



Contribution to Tracking Error

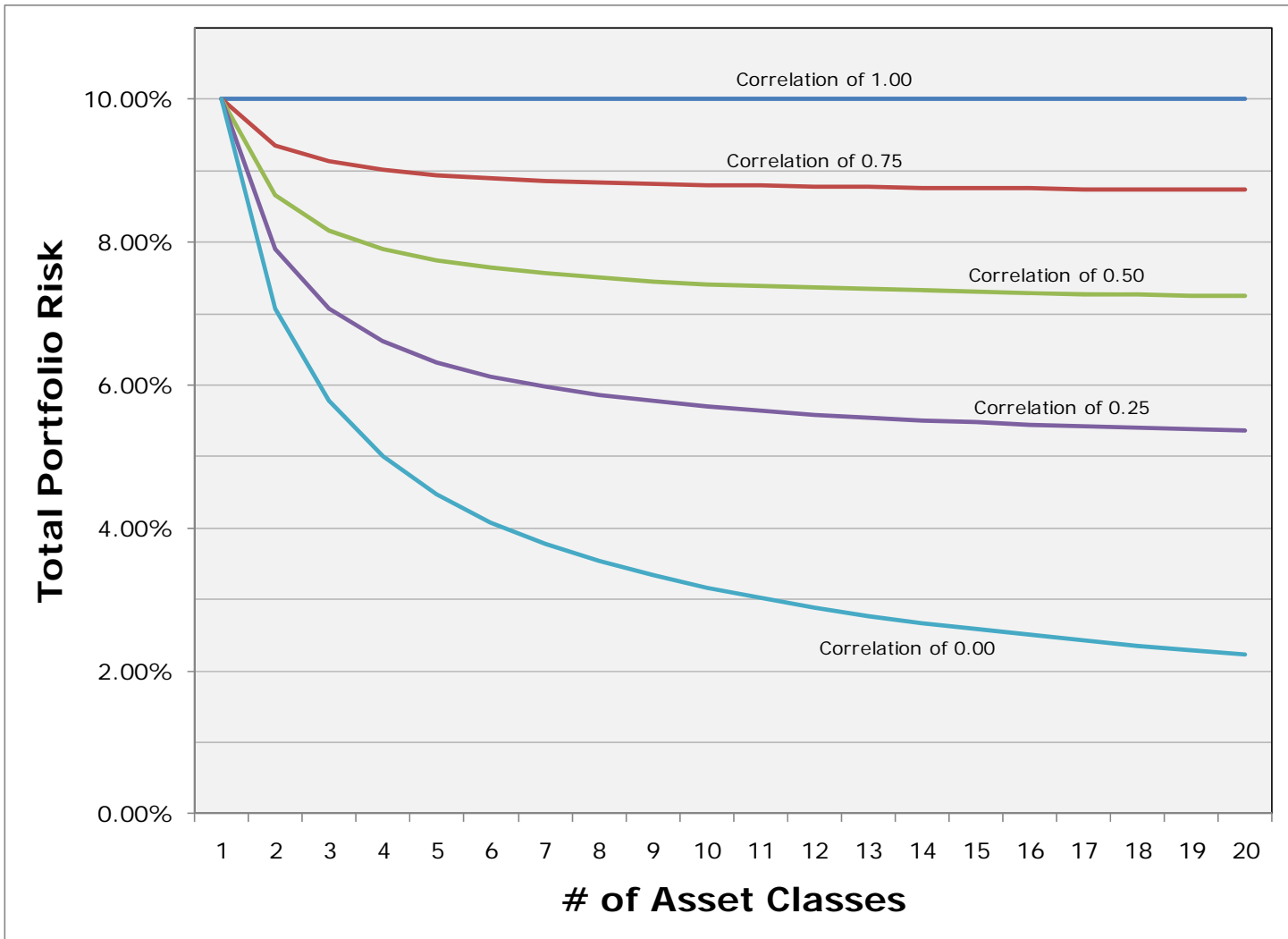


- This tracking error forecast is based on asset allocation variances only
- Other sources of tracking error (structural within asset classes, manager/program specific source of tracking error, covariance) are not considered here

Forecasts using Wilshire's 2010 Asset Class Assumptions

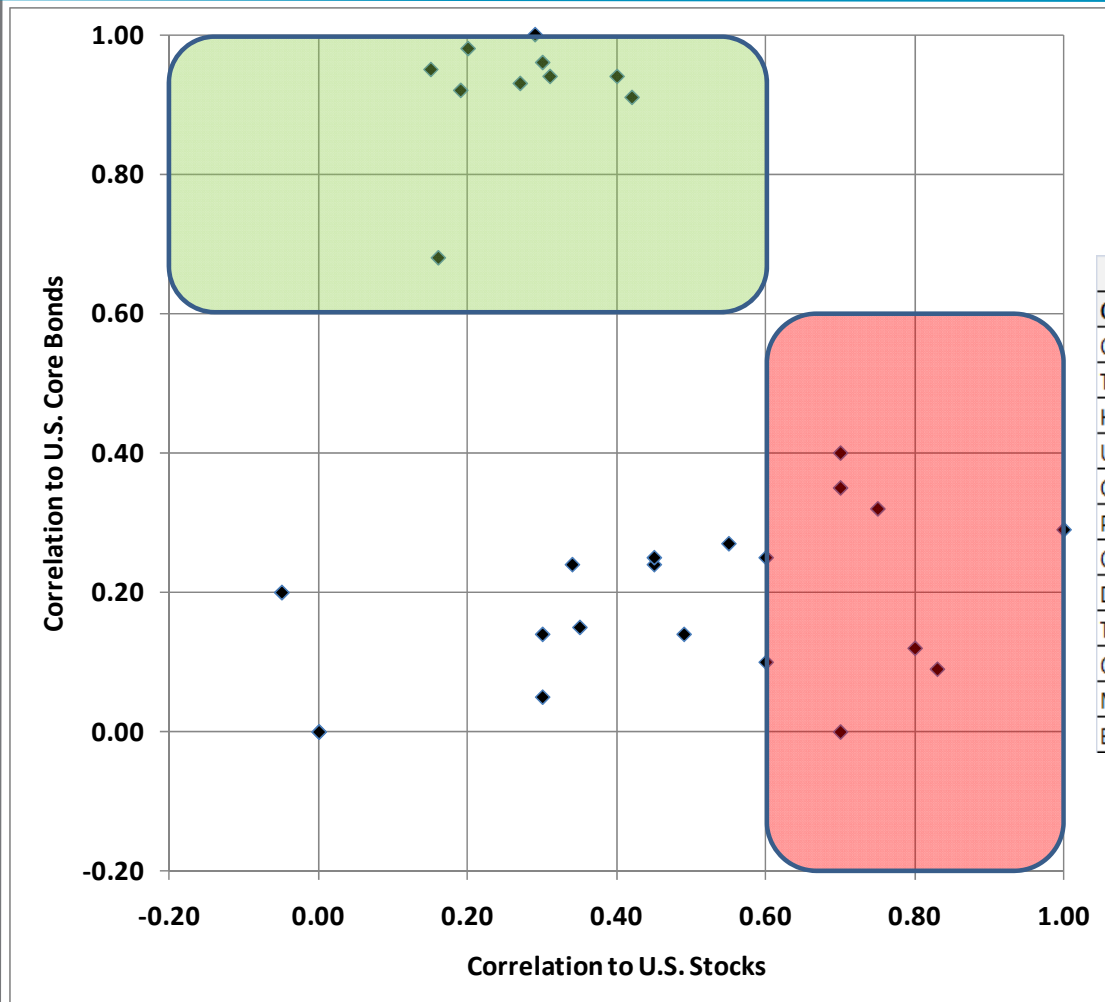
An Examination of Diversification

The Deception of Diversification



The expected correlation between asset classes is more important than the number of asset classes included when seeking true diversification

Correlation Matters

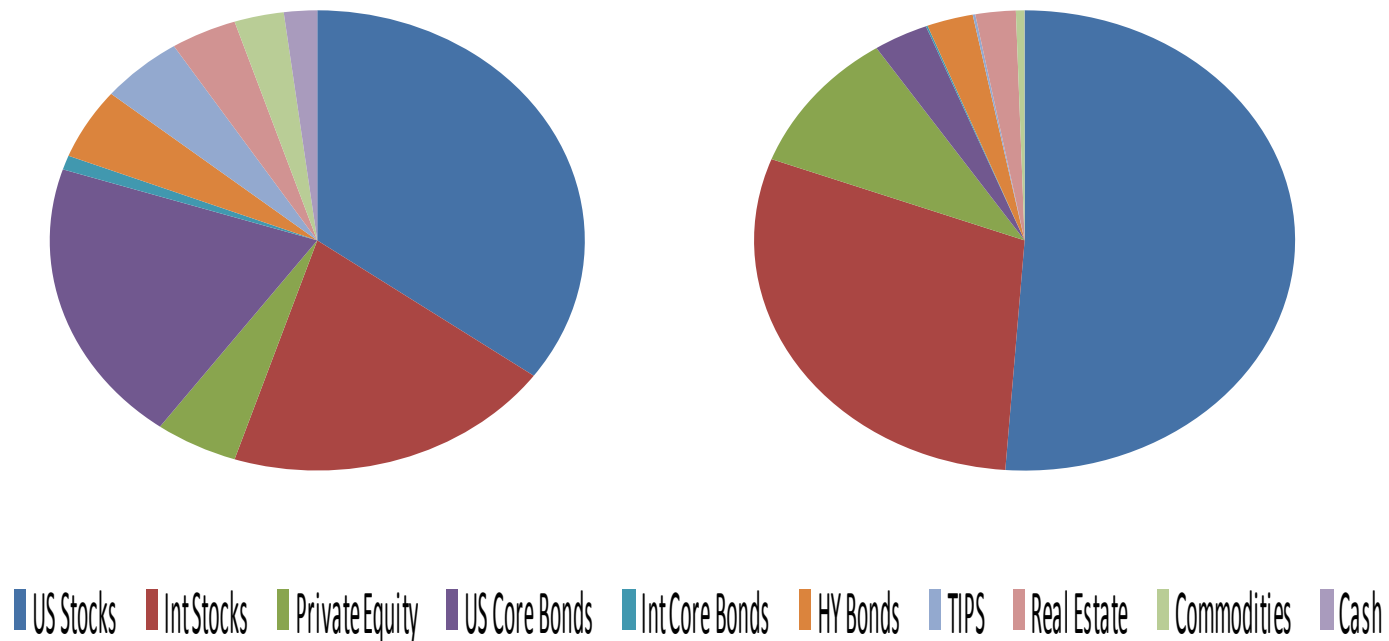


Low/Low Asset Classes		
Class	Correlation to Stocks	Correlation to Bonds
Cash Equivalents	-0.05	0.20
TIPS	-0.05	0.20
High Yield Bond	0.55	0.27
US RE Securities	0.35	0.15
Global RE Securities	0.49	0.14
Private Real Estate	0.34	0.24
Commodities	0.00	0.00
Distressed Debt	0.30	0.05
Timberland	0.00	0.00
Oil & Gas Partnerships	0.30	0.14
Natural Resources	0.45	0.24
Emerging Mkt Debt (USD)	0.45	0.25

Examining the expected roles of asset classes and the expected performance of each under a variety of economic scenarios can ameliorate false diversification

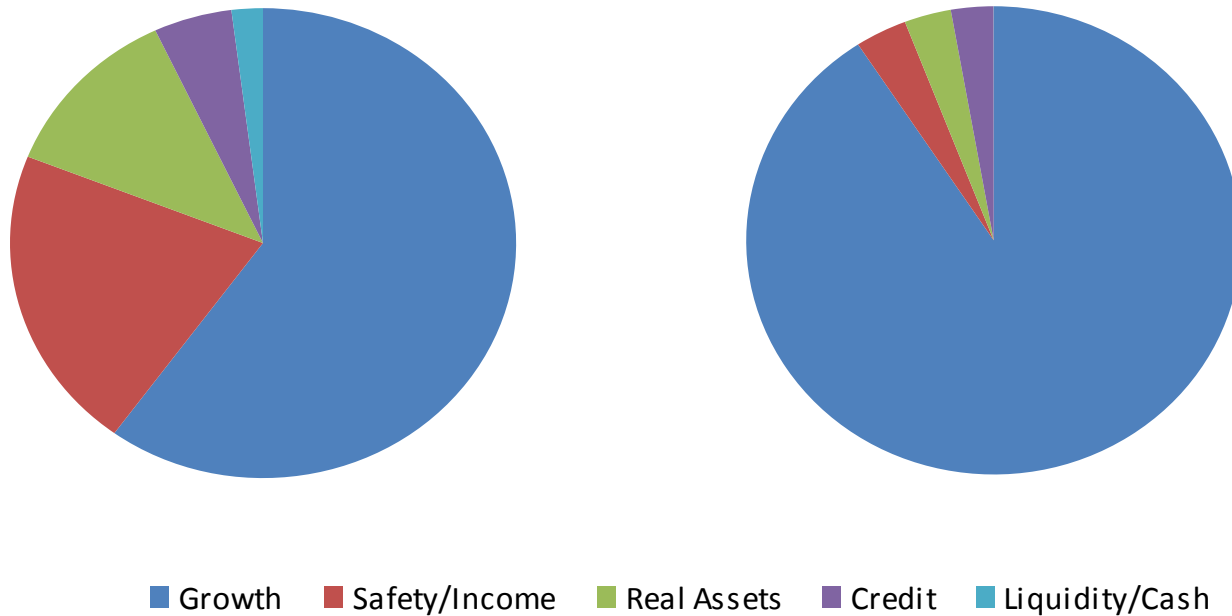
Diversification: Capital Allocated vs. Risk Allocated

Capital (left) & Risk (right) Allocations by Asset Class



Number of asset classes \neq diversification

Diversification: Capital Allocated vs. Utility Buckets

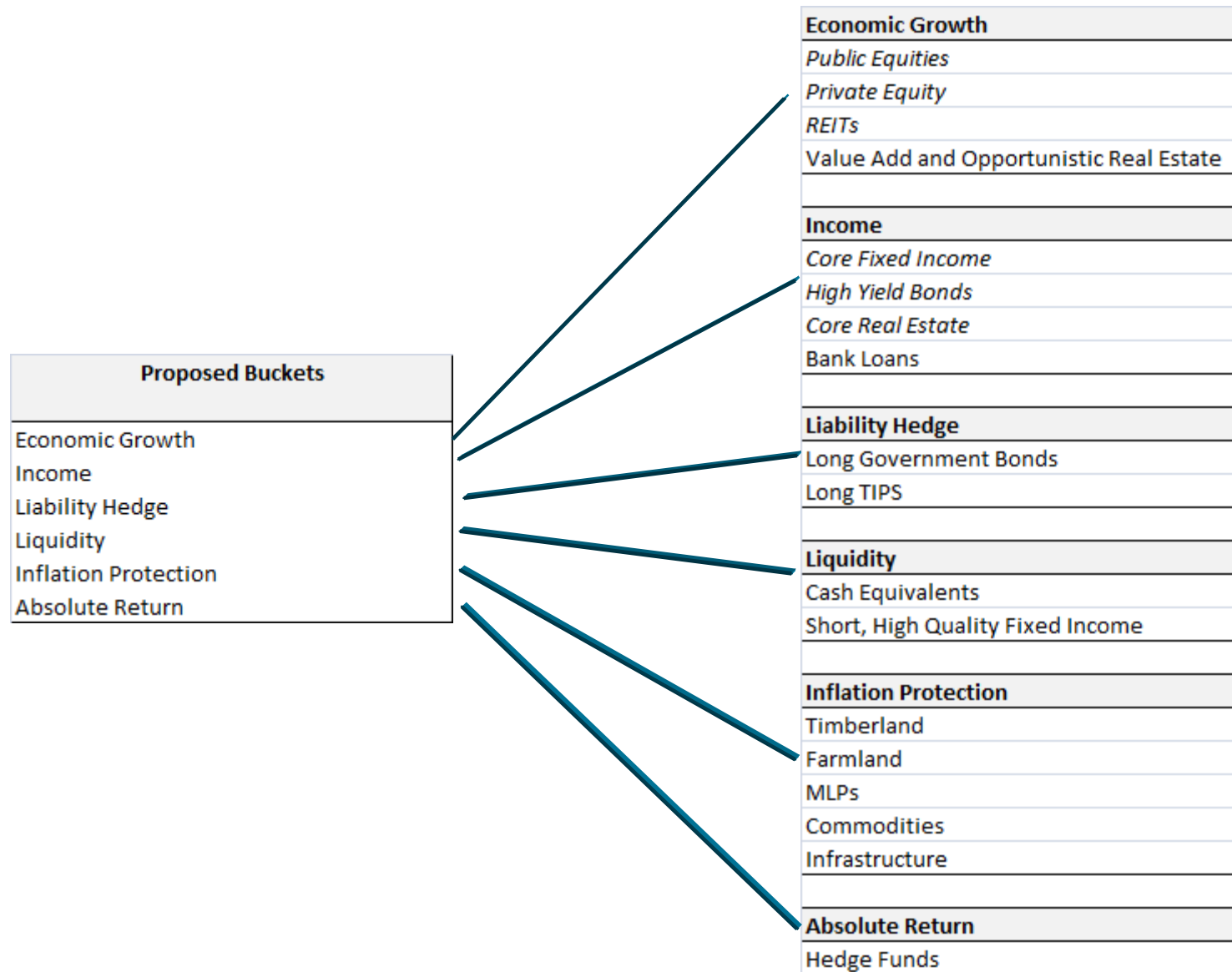


Particularly when many play the same role

Which risk should be addressed?

- While volatility of return is the standard definition of risk, it is not the only risk that investors face?
 - Risk of loss – the volatility drain
 - Inflation/deflation impacts
 - Liquidity needs
 - Cash flow needs
 - Interest rate risk
 - Credit risk
 - Funding requirements
 - Low returns (either market driven or opportunity cost)
- Mitigating risk is like buying insurance

Portfolio Utility Buckets



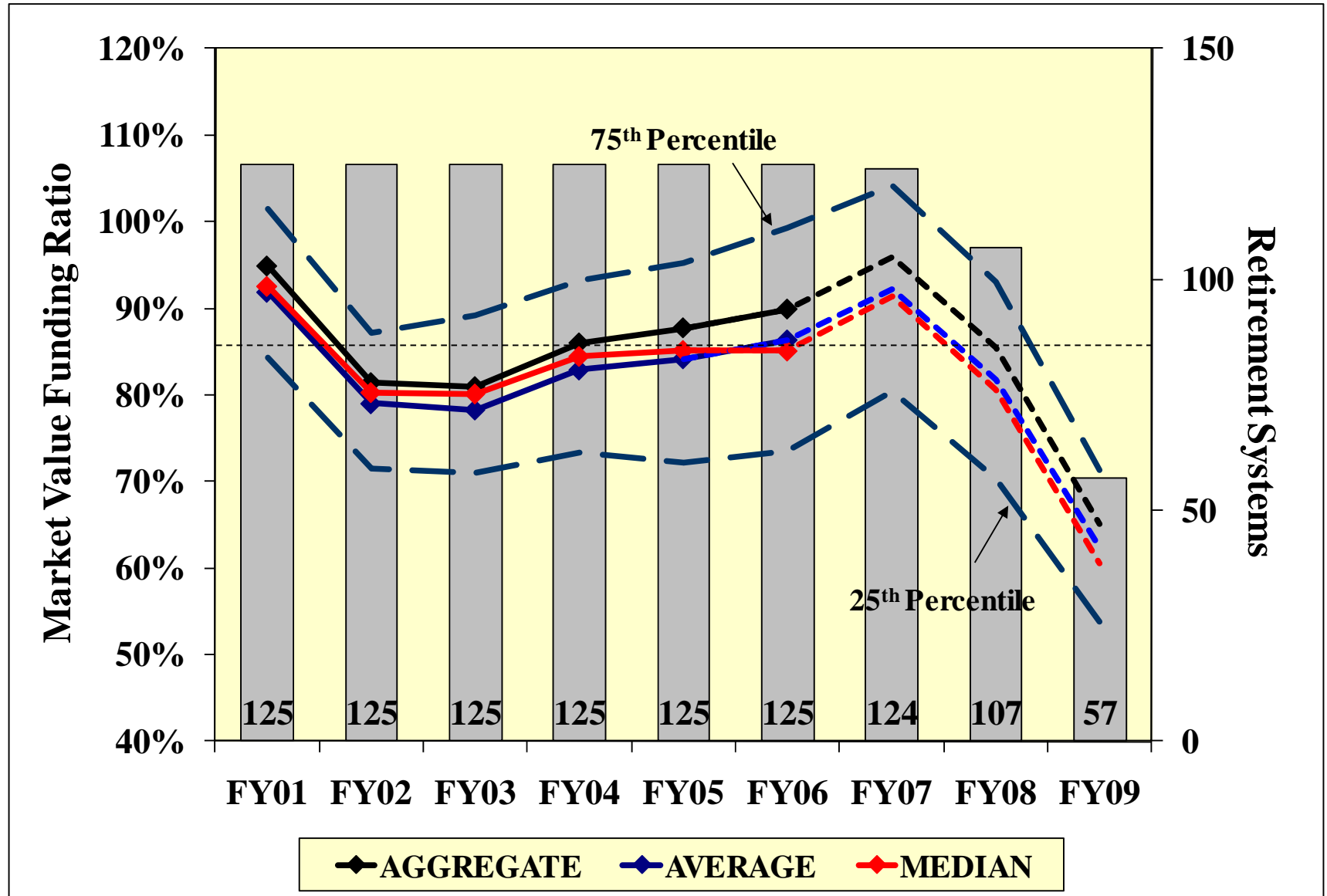
Roles of Asset Classes

- Clearly defining the roles of various asset classes helps identify which assets protect against specific risks

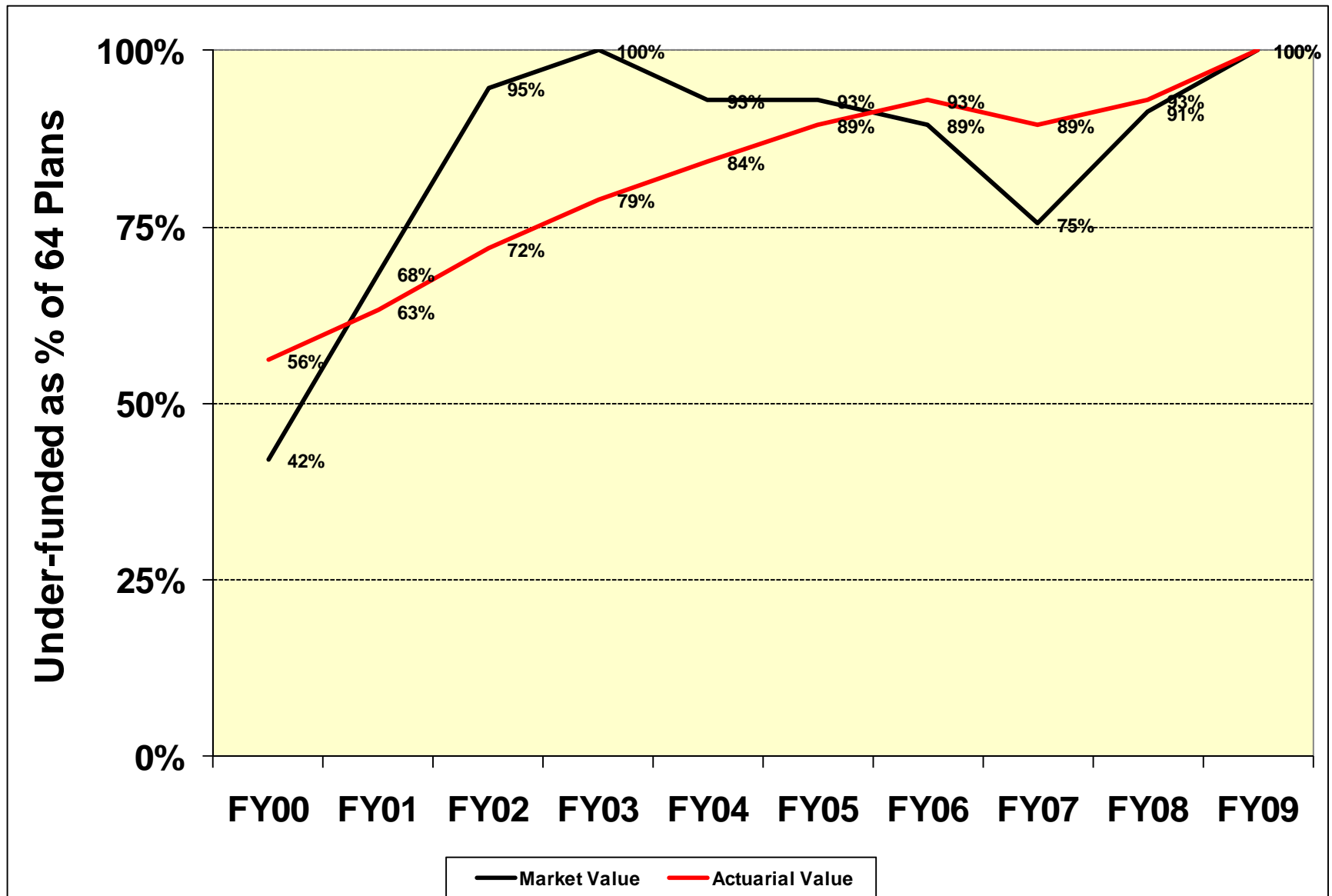
Asset Class	Role	Generally successful during...	Risk of loss?	Performance during		Liquid?	Income producing?	Interest rate risk?	Credit Risk?
				Inflation?	Deflation?				
Cash/Money Market Funds	Store value	Generally, all periods	No	Generally protects	Does not lose value	Yes	Nil	No	No
Equity - public and private	Generate meaningful return	Periods of economic growth	Severe	Depends	Likely poor?	Yes	Minor	Yes, at much higher rates	Yes
Investment grade bonds	Produce income	Stable and falling interest rate regimes	Moderate	Poor	Good?	Moderate	Yes	Yes	Yes
Treasuries	Produce Income	Stable and falling interest rate regimes	No	Poor	Good?	Highly	Yes	Yes	No
TIPS	Income plus inflation protection	Stable and rising inflationary regimes	No	Good	Poor?	Yes	Moderate	Yes, for real rates	No
Mortgages/Corporates	Produce income	Stable and falling interest rate regimes	Moderate	Poor	Bad?/Good?	Moderate	Yes	Yes	Yes
High yield bonds	Produce income	Stable and falling interest rate regimes	High	Modest	Good?	Yes, but limited	Yes	Yes	High
High yield bank loans	Produce income	stable and rising interest rate regimes	High	Good	Likely poor?	Yes, but limited	Yes	No	Yes
Real Assets									
Core real estate	Produce income, modest inflation protection	Stable economy, modest inflation, stable interest rates	High	Modest	Likely poor?	No	Yes	Yes	Indirect
REITs	Produce income, modest inflation protection	Stable economy, modest inflation, stable interest rates	High	Modest	Likely poor?	Yes	Yes	Yes	Yes
Timber	Produce income, inflation protection	Stable economy, rising inflation, stable interest rates	Moderate	Good	Likely poor?	No	Yes	Yes	No
Commodities	Inflation protection	Rising/high inflation	Severe	Very good	Very bad	Yes	No	No	No
Private Infrastructure	Produce income, inflation protection	Stable economy, rising inflation, stable interest rates	Moderate	Good	Likely poor?	No	Yes	Yes	Yes
Public infrastructure (MLPs)	Produce income, inflation protection	Stable economy, rising inflation, stable interest rates	High	Good	Likely poor?	Yes	Yes	Yes	Yes
Absolute Return - Hedge Funds	Generate return, with low risk of loss	Stable or tightening credit spreads, cheap financing costs	Moderate	?	?	No	No	Yes	Yes

Trends Among State Pension Systems

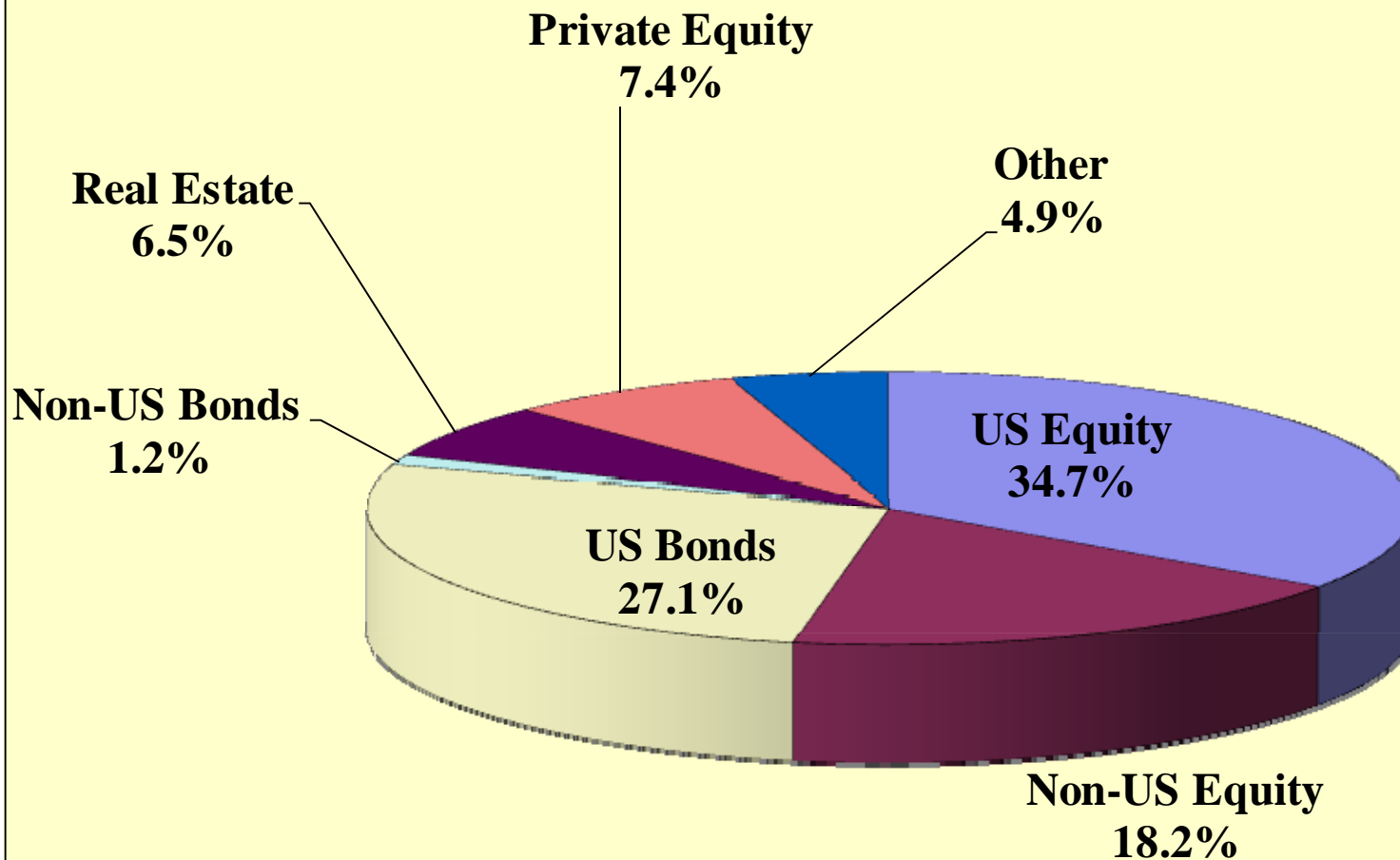
Funding Trends: Market Value of Assets vs. Liabilities



% Underfunded (of 57 Plans with 2009 Data)



Average Asset Allocation for State Plans

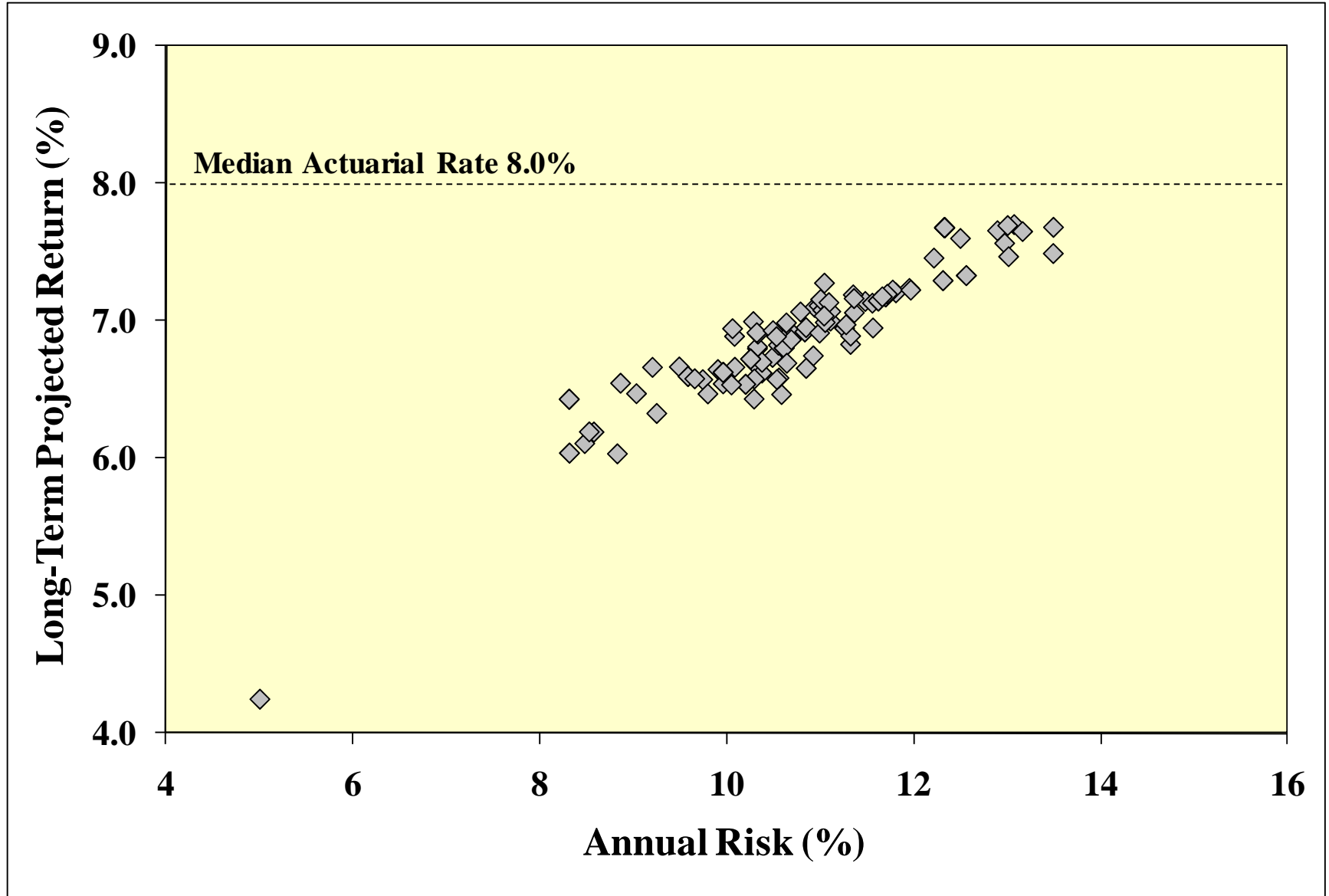


Average Asset Allocation for State Plans

	<u>2003</u>	<u>2009</u>	<u>Change</u>
Equity			
US Equity	42.3 %	34.7 %	-7.6 %
Non-US Equity	12.9	18.2	5.3
Real Estate	4.0	6.5	2.5
Private Equity	4.2	7.4	3.2
Equity Subtotal	63.4	66.8	3.4
Debt			
US Bonds	35.2	27.1	-8.1
Non-US Bonds	1.4	1.2	-0.2
Other	0.0	4.9	4.9
Debt Subtotal	36.6	33.2	-3.4
Return *	6.7	6.9	0.2
Risk *	10.3	10.7	0.4

* Risk and Return estimates based on Wilshire's current asset class assumptions

Expected Risk & Return vs. Median Actuarial Rate



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Economic Scenarios and Asset Returns

Lorne Johnson
Portfolio Manager
Asset Allocation

November 8, 2010

Economic Scenarios and Asset Returns

Asset Returns Vary Substantially Depending on Economic Conditions

- During periods of weak forward looking economic growth, real returns to risky assets are on average negative.
- During periods of high inflation, real returns on most assets perform poorly. The exceptions historically are inflation-protected securities and commodities.

Economic Growth and Asset Returns

- The expected performance of many CalPERS asset classes is conditional on the prevailing economic growth regime
- For Public Equity, Private Equity, Real Estate, and High Yield, real performance is on average negative if Leading Economic Indicators (LEIs) are pointing downward
- Forward-looking financial markets move ahead of actual GDP growth, but are coincident or slightly behind LEIs
- Government Bonds are a unique asset class given the historical relative insensitivity of their performance over the business cycle

Framework for Evaluating Asset Class Performance by Economic Regime

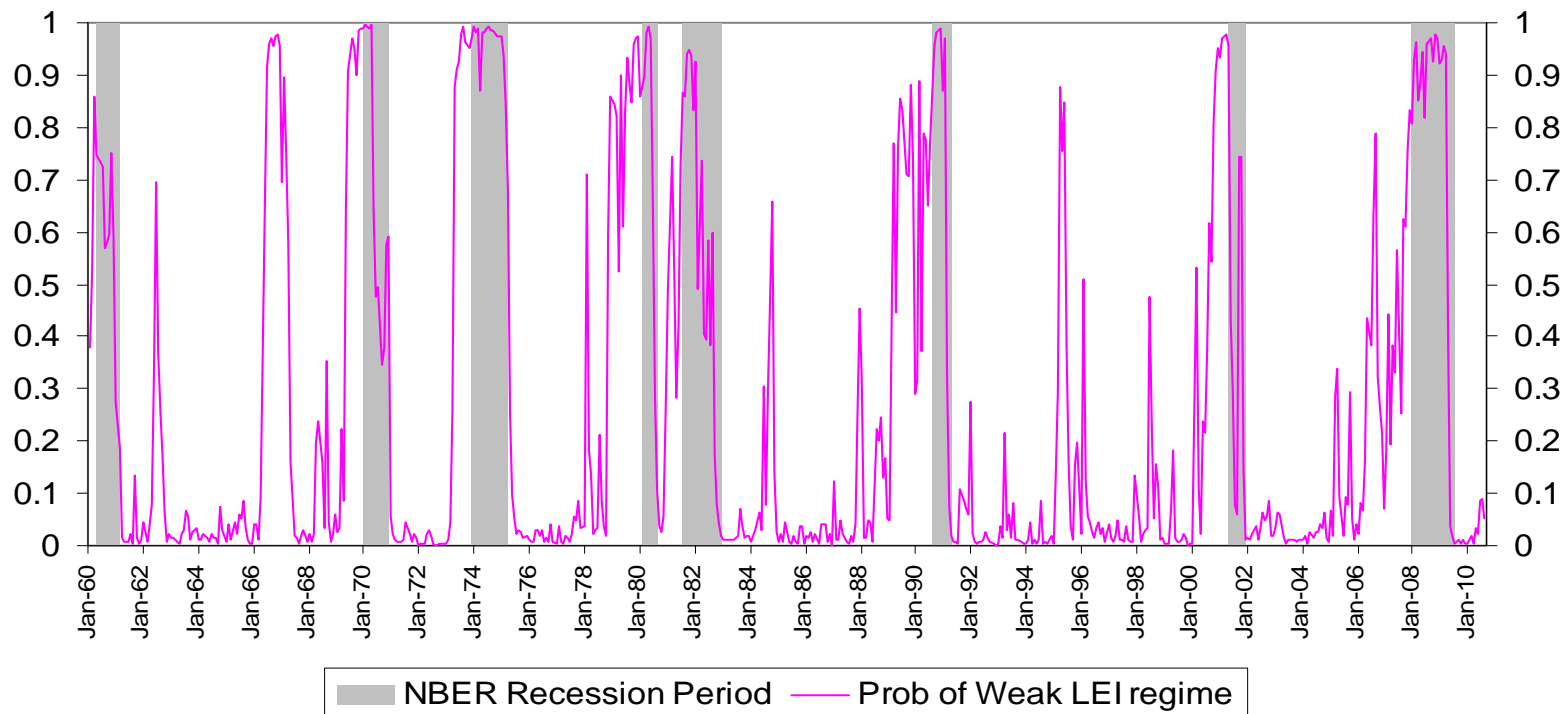
A Regime Switching Model of LEIs

- A regime model for identifying persistent periods of forward looking positive and negative economic performance is developed for assessing the relative performance of asset classes conditional on forward looking economic growth.
- The model estimated has the following parameters:
 - probability of staying in an expansion regime next month: 98.6%
 - probability of staying in a contraction regime next month: 92.7%
 - expected duration of expansion regime: 71 months
 - expected duration of contraction regime: 17 months
 - LEI growth rate in expansion regime: 0.45%
 - LEI growth rate in contracting regime: - 0.30%
- A contracting economic regime is identified for purposes of conditioning where the observed probability of an LEI expansion regime is less than 0.4.

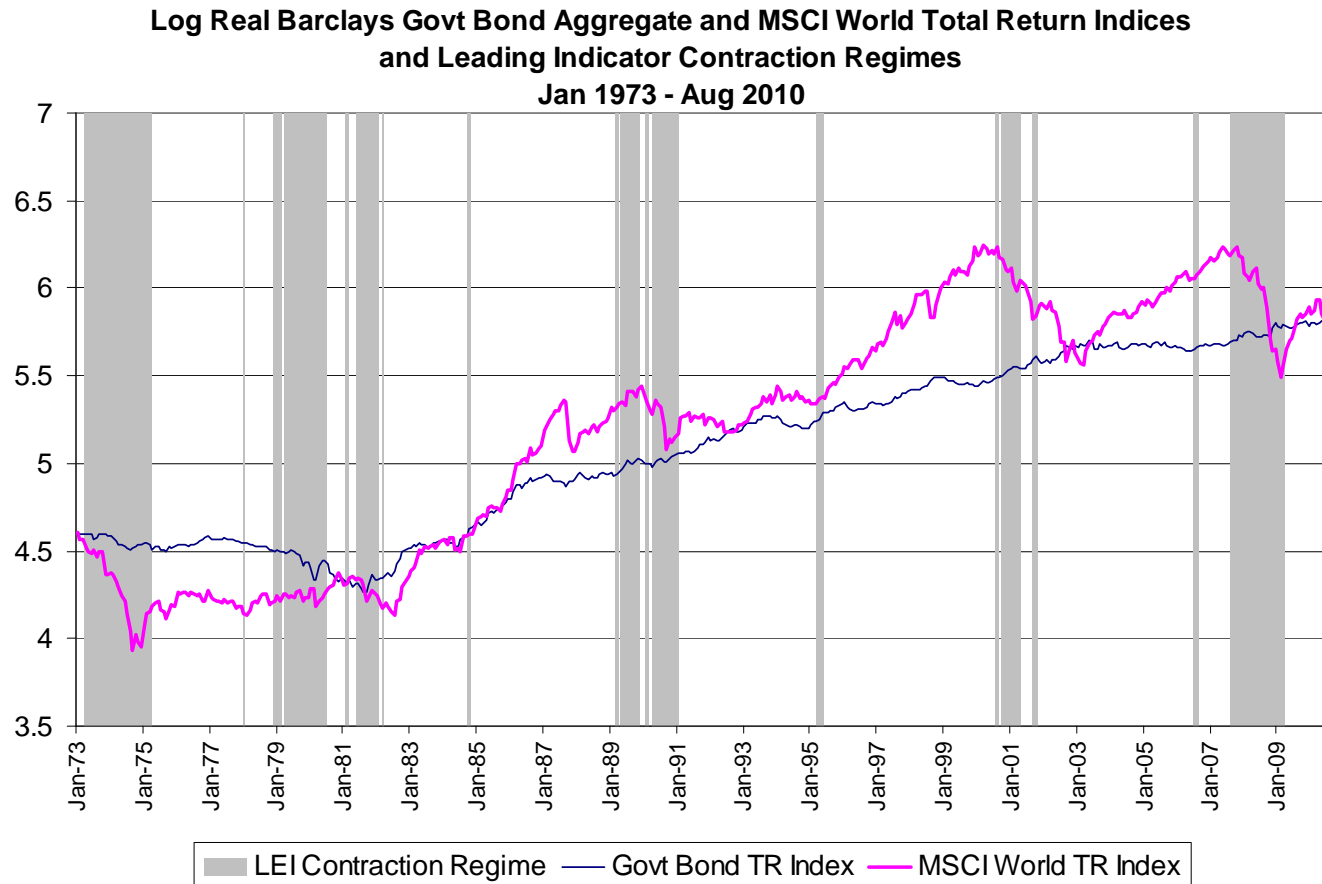
Measuring Economic Growth/Contraction Regimes

Probability of Economic Contraction Estimated by LEI Regime Model

Jan 1970 – Aug 2010



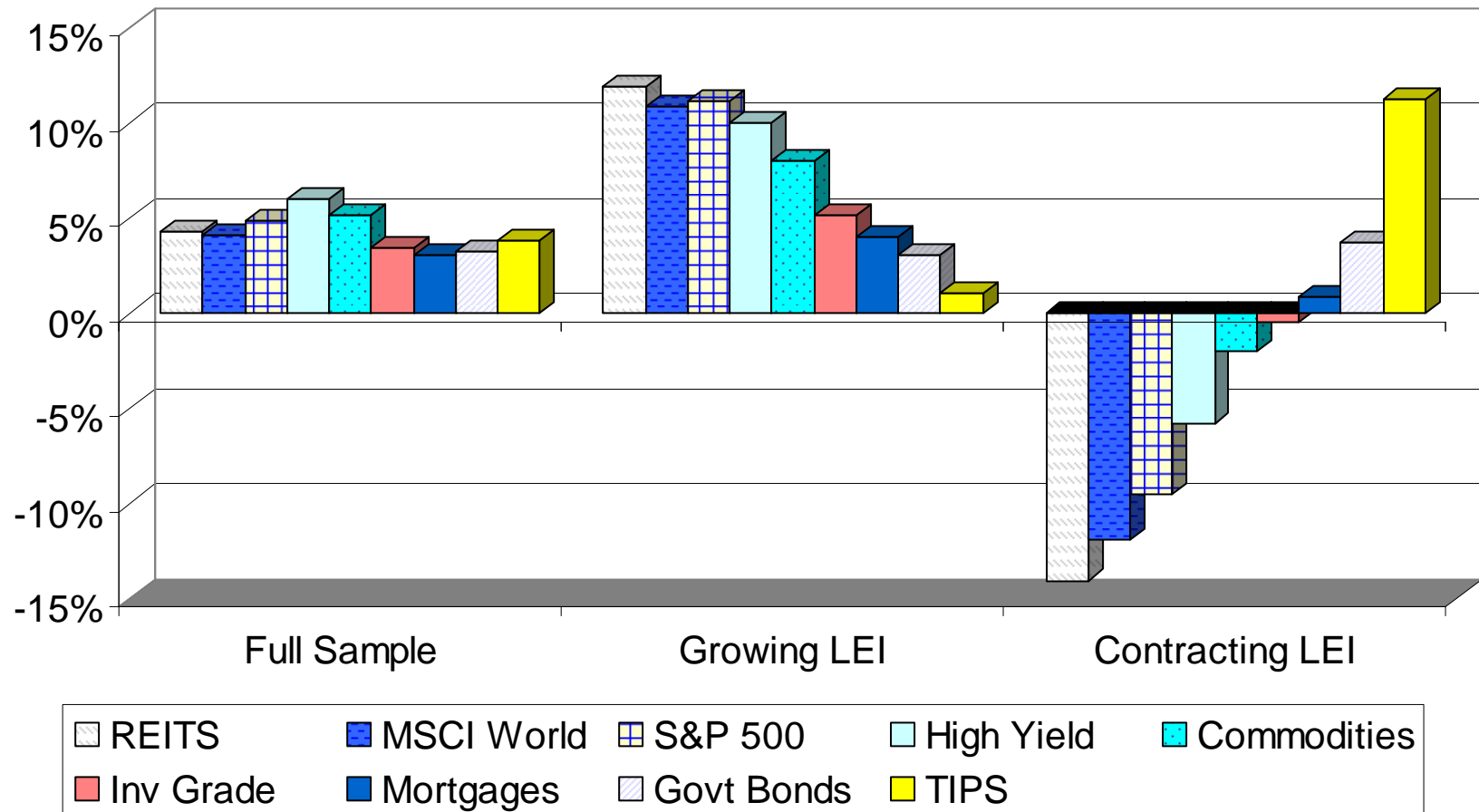
Asset Returns Over the Business Cycle



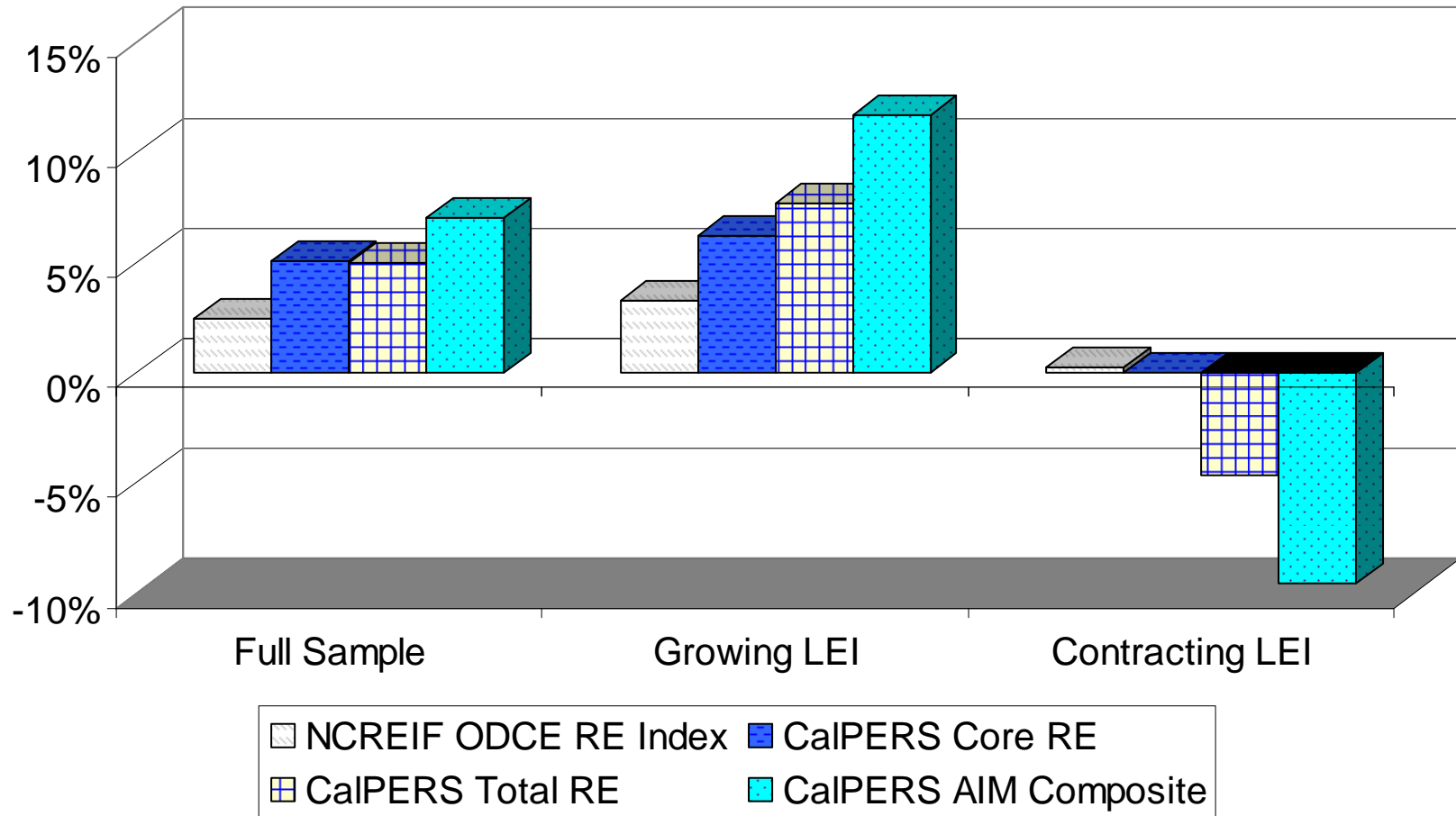
Economic Contractions Occur Frequently and are a Regular Feature of the Business Cycle

Period	Months in Contraction Regime	Percent of Months	Compound Annualized Real Equity Return*
1960 - 2009	139	23%	5.12%
1960's	26	22%	6.02%
1970's	42	35%	-0.68%
1980's	25	21%	10.52%
1990's	14	12%	15.50%
2000's	32	27%	-2.97%
2010's	??	??	??

Real Annualized Returns by LEI Regime



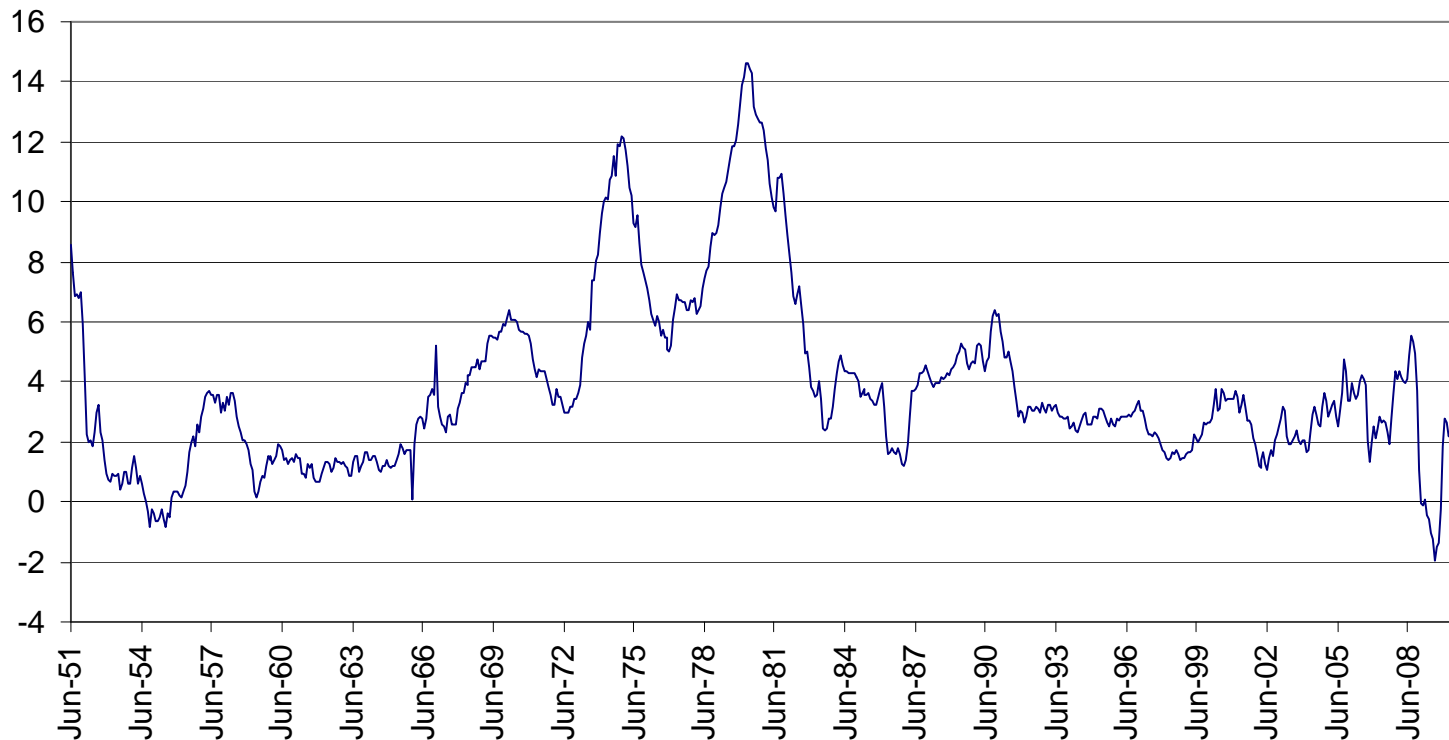
Real Annualized Returns by LEI Regime for ODCE Real Estate Index and CalPERS Real Estate and AIM Programs



Inflation Regimes are Highly Persistent

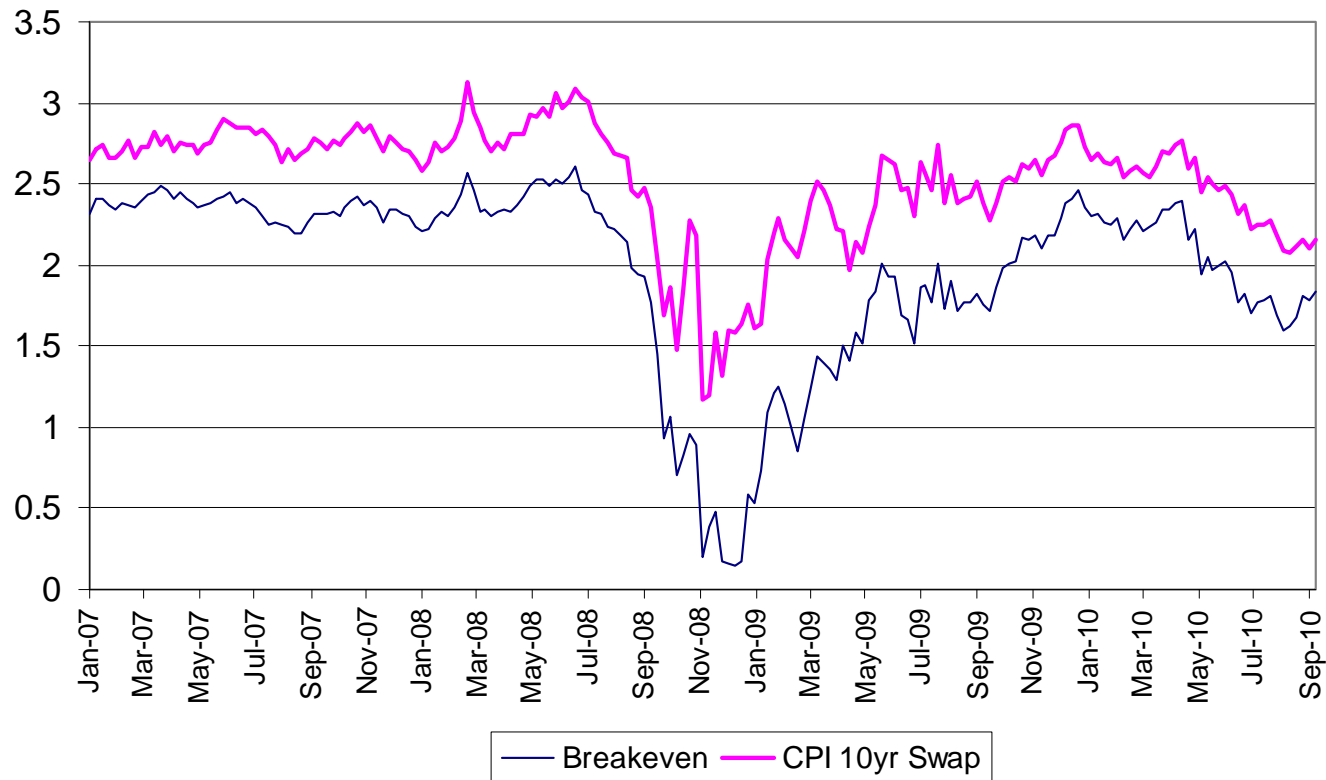
High Inflation has been largely dormant since the 1980's

Year over Year change in Consumer Price Index
June 1950 - August 2010

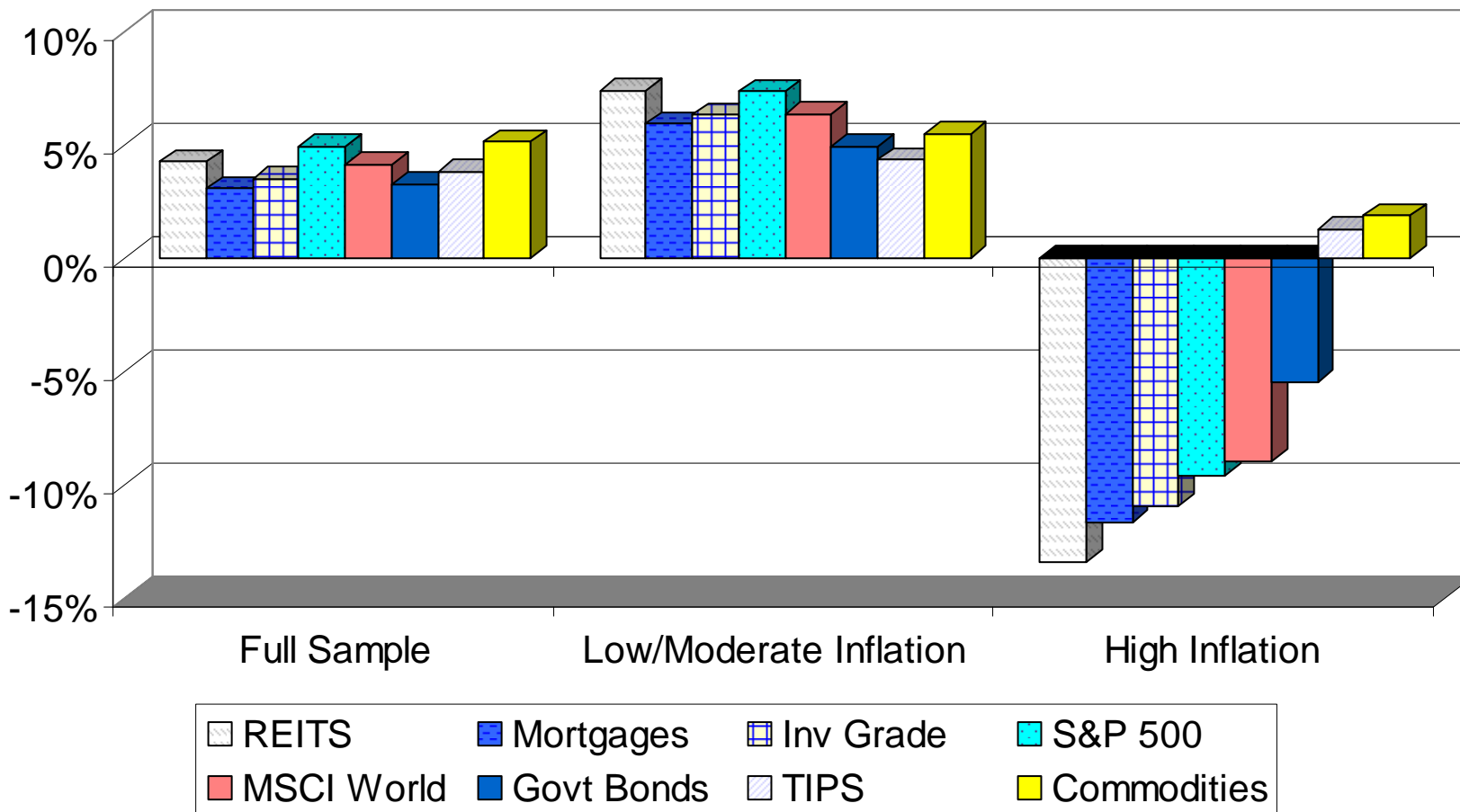


Current Inflation Expectations are Very Low

**10 Year Forward Market Inflation Measures
January 2007 - September 2010**



Real Annualized Returns by Inflation Regime



Annualized Total Real Return to Selected Portfolios Jan 1973 - Dec 2009

	Portfolio					
	<i>S&P 500</i>	<i>BarCap GovAgg</i>	<i>60/40</i>	<i>40/60</i>	<i>Inflation Hedging</i>	<i>40/30/30</i>
Full Sample	4.90%	3.26%	4.53%	4.21%	4.55%	4.70%
1990 - 2009	5.20%	3.90%	5.03%	4.72%	3.67%	4.70%
1970's	-4.27%	-2.40%	-3.58%	-3.11%	7.20%	0.00%
1980's	10.52%	6.38%	9.23%	8.03%	5.60%	7.99%
1990's	15.50%	4.51%	10.60%	8.54%	2.90%	8.19%
2000's	-2.97%	3.69%	0.30%	1.28%	4.44%	1.44%

Annualized Standard Deviation of Selected Portfolios Jan 1973 - Dec 2009

	Portfolio					
	<i>S&P 500</i>	<i>BarCap GovAgg</i>	<i>60/40</i>	<i>40/60</i>	<i>Inflation Hedging</i>	<i>40/30/30</i>
Full Sample	15.63%	5.38%	10.02%	7.38%	11.69%	8.22%
1990 - 2009	15.01%	4.41%	9.44%	6.63%	11.90%	7.70%
1970's	15.96%	4.09%	10.64%	7.78%	12.75%	7.77%
1980's	16.42%	7.37%	11.32%	8.95%	10.44%	9.39%
1990's	13.40%	4.19%	8.78%	6.69%	9.30%	6.92%
2000's	16.16%	3.92%	9.83%	6.43%	14.06%	8.34%

- 60/40 Portfolio: 60% Equities, 40% Bonds; 40/60 Portfolio: 40% Equities, 60% Bonds
- Inflation Hedging Portfolio: 50% Commodities, 50% TIPS
- 40/30/30 Portfolio: 40% Equities, 30% Bonds, 30% Inflation Hedging

Simple Real Return/Risk of Selected Portfolios
Jan 1973 - Dec 2009

	Portfolio					
	<i>S&P 500</i>	<i>BarCap GovAgg</i>	<i>60/40</i>	<i>40/60</i>	<i>Inflation Hedging</i>	<i>40/30/30</i>
Full Sample	0.31	0.61	0.45	0.57	0.39	0.57
1990 - 2009	0.35	0.88	0.53	0.71	0.31	0.61
1970's	-0.27	-0.59	-0.34	-0.40	0.56	0.00
1980's	0.64	0.87	0.82	0.90	0.54	0.85
1990's	1.16	1.08	1.21	1.28	0.31	1.18
2000's	-0.18	0.94	0.03	0.20	0.32	0.17

- 60/40 Portfolio: 60% Equities, 40% Bonds; 40/60 Portfolio: 40% Equities, 60% Bonds
- Inflation Hedging Portfolio: 50% Commodities, 50% TIPS
- 40/30/30 Portfolio: 40% Equities, 30% Bonds, 30% Inflation Hedging

**Total Real Return to Selected Portfolios
During Recent Periods of Financial Market Stress**

	Portfolio					
	<i>S&P 500</i>	<i>BarCap GovAgg</i>	<i>60/40</i>	<i>40/60</i>	<i>Inflation Hedging</i>	<i>40/30/30</i>
Full Sample	4.90%	3.26%	4.53%	4.21%	4.55%	4.70%
1987Q4 Stock Market Crash	-23.40%	4.51%	-12.30%	-6.70%	1.96%	-9.95%
1994 Interest Rate Spike	-1.30%	-5.40%	-3.10%	-4.01%	-4.98%	-3.36%
1998Q3 LTCM/Russian Default	-10.30%	5.10%	-4.03%	-0.95%	-1.11%	-3.70%
2000 - 2002 Dot Com Crash	-43.00%	19.90%	-28.70%	-8.90%	14.70%	-16.19%
2008 - 2009 Bear/Lehman/TARP	-45.00%	2.50%	-21.50%	-19.26%	-38.90%	-31.50%

- 60/40 Portfolio: 60% Equities, 40% Bonds; 40/60 Portfolio: 40% Equities, 60% Bonds
- Inflation Hedging Portfolio: 50% Commodities, 50% TIPS
- 40/30/30 Portfolio: 40% Equities, 30% Bonds, 30% Inflation Hedging

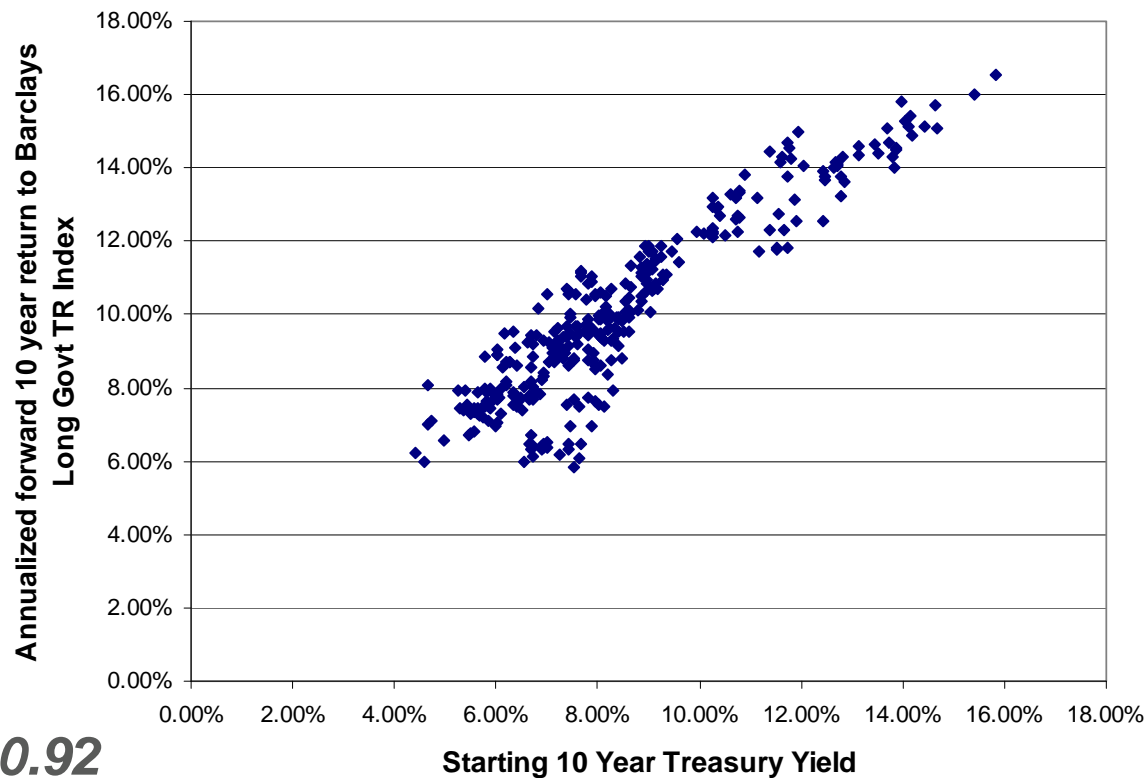
What are Reasonable Capital Market Assumptions under Different Economic Scenarios Based on Historical Experience and Initial Conditions?

Scenario 1: Base Case

	<u>Nominal 10 year assumptions</u>	<u>Real 10 year assumptions</u>	<u>Assumed Weights</u>
Total Fixed Income	3.75%	0.75%	15.90%
Public Equities	7.75%	4.75%	49.10%
Private Equity (AIM)	9.00%	6.00%	14.00%
Real Estate	7.00%	4.00%	10.00%
Infrastructure and Forestland	7.00%	4.00%	3.00%
TIPS	3.50%	0.50%	3.00%
Commodities	5.00%	2.00%	1.00%
Liquidity	3.25%	0.25%	4.00%
Inflation	3.00%	-	-
Expected Annualized Portfolio Return	7.38%	4.38%	

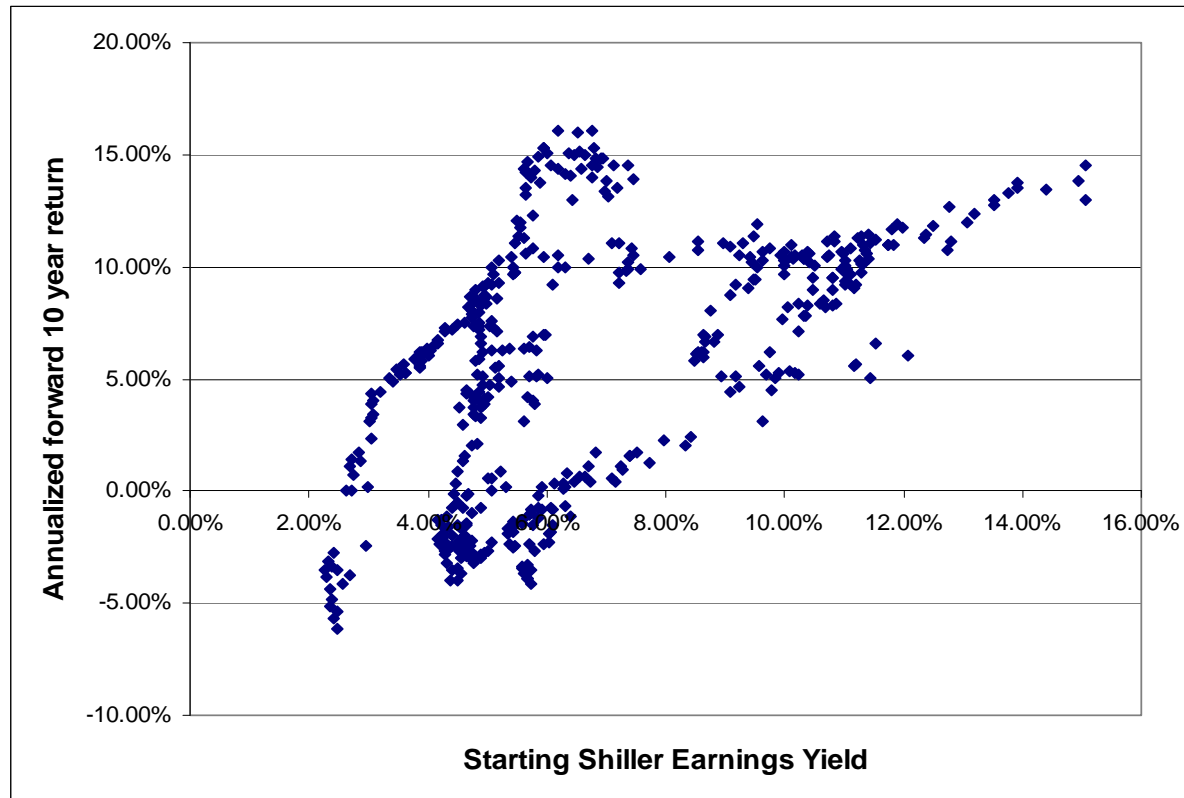
The current Treasury Yield is a Good Predictor of Future Government Bond Returns

Initial 10 yr Yield and Forward Annualized Monthly 10 year Total Returns
for Barclays Long Govt Agg Index - 1973 - 2010



The current earnings yield is a good predictor of future returns

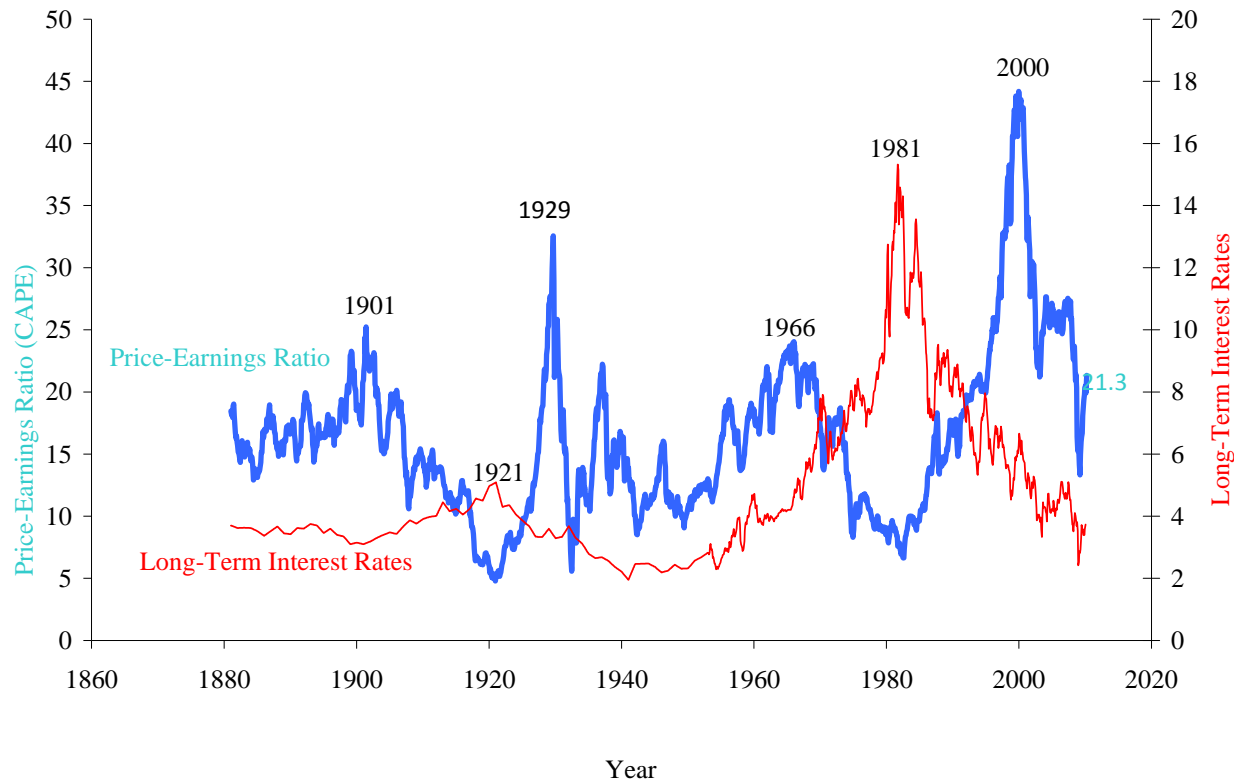
Initial Shiller Earnings Yield and Forward Annualized Monthly
10 year Real Total Returns for S&P 500
1960 - 2009



Correlation: 0.56

Valuations are mean reverting

Shiller P/E Ratio* 1880 - 2010



*Real price over real rolling 10 year earnings

Initial Conditions also Matter

Realized Real Equity Returns under Different Initial Conditions - Jan 1980

Economic Backdrop: The US economy is about to enter a double dip recession just five years since the last recession. Double digit inflation persists after a decade long regime of increasing inflation.

- 10 year Treasury bond yield = 11%
- Dividend yield = 5%
- Earnings yield = 11%
- Shiller P/E = 9
- Return expectation from yield = 5%
- Return expectation from earnings growth = 2%
- Return expectation from valuation adjustment to average = 6%
- Expected annual real equity return based on initial conditions = 13%
- *Subsequent 10 year annualized real return to U.S. equities = 10.5%*

Initial Conditions also Matter

Realized Real Equity Returns under Different Initial Conditions - Jan 2000

Economic Backdrop: Inflation has been on the decline for nearly 20 years. US unemployment is near postwar lows. The economy has been growing briskly.

- 10 year Treasury bond yield = 6.5%
- Dividend yield = 1.1%
- Earnings yield = 2%
- Shiller P/E = 43
- Return expectation from yield = 1.5%
- Return expectation from earnings growth = 2%
- Return expectation from valuation adjustment to average = (9%)
- Expected annual real return based on initial conditions = (5.5%)
- *Subsequent 10 year annualized real return to U.S. equities = (3%)*

Initial Conditions Also Matter

Realized Real Equity Returns under Different Initial Conditions – Oct 2010

Economic Backdrop: The global Economy has just emerged from its worst postwar recession. Central banks are very loose. Debt to GDP ratios in developed countries remain at all time highs. Inflation expectations are benign.

- 10 year bond yield = 2.5%
- Dividend yield = 1.8%
- Earnings yield = 4.7%
- Shiller P/E = 21.3
- Return expectation from yield = 3%
- Return expectation from growth = 2%
- Return expectation from valuation adjustment = (1%) maybe
- Expected annual real return based on initial conditions = 4%
- Inflation Rising/Falling ??????
- *Subsequent 10 year real return to equities = ??*

What Would Our Capital Market Assumptions be Under Other Plausible Economic Scenarios?

Scenario 2: Goldilocks Returns. Low Inflation and Better Than Expected Growth

	<u>Nominal 10 year assumptions</u>	<u>Real 10 year assumptions</u>	<u>Assumed Weights</u>
Total Fixed Income	4.25%	2.25%	15.90%
Public Equities	10.50%	8.50%	49.10%
Private Equity (AIM)	11.75%	9.75%	14.00%
Real Estate	7.00%	5.00%	10.00%
Infrastructure and Forestland	5.00%	3.00%	3.00%
TIPS	3.00%	1.00%	3.00%
Commodities	8.00%	6.00%	1.00%
Liquidity	2.75%	0.75%	4.00%
Inflation	2.00%	-	-
Expected Annualized			
Portfolio Return	9.11%	7.11%	

What Would Our Capital Market Assumptions be Under Other Plausible Economic Scenarios?

Scenario 3: Economy Fails to Catch Steam. Japanese Low Growth, Zero Inflation Outcome

	<u>Nominal 10 year assumptions</u>	<u>Real 10 year assumptions</u>	<u>Assumed Weights</u>
Total Fixed Income	4.75%	3.75%	15.90%
Public Equities	4.00%	3.00%	49.10%
Private Equity (AIM)	5.25%	4.25%	14.00%
Real Estate	0.00%	-1.00%	10.00%
Infrastructure and Forestland	4.00%	3.00%	3.00%
TIPS	2.00%	1.00%	3.00%
Commodities	0.50%	-0.50%	1.00%
Liquidity	2.50%	1.50%	4.00%
Inflation	1.00%	-	-
Expected Annualized Portfolio Return	4.28%	3.28%	

What Would Our Capital Market Assumptions Be Under Other Plausible Economic Scenarios?

Scenario 4: That 70's Feeling. High Inflation and High Uncertainty High Inflation and High Uncertainty

	<u>Nominal 10 year assumptions</u>	<u>Real 10 year assumptions</u>	<u>Assumed Weights</u>
Total Fixed Income	5.00%	0.00%	15.90%
Public Equities	5.00%	0.00%	49.10%
Private Equity (AIM)	6.25%	1.25%	14.00%
Real Estate	7.00%	2.00%	10.00%
Infrastructure and Forestland	7.00%	2.00%	3.00%
TIPS	6.00%	1.00%	3.00%
Commodities	10.00%	5.00%	1.00%
Liquidity	3.50%	-1.50%	4.00%
Inflation	5.00%	-	-
Expected Annualized Portfolio Return	5.99%	0.99%	

Conclusions

- Investment returns are dependent on initial conditions and the prevailing economic environment
- Periods of low growth and/or high inflation present risks to the current CalPERS portfolio
- A more flexible asset allocation structure with the ability to directly hedge growth and inflation risks provides a more robust framework to respond to changing economic environments

Asset Class Roles and Outlook

November 8, 2010

Current & Alternative Classification

Current Targets

Fixed Income (GFI)	20%
Public Equity (GE)	49%
Private Equity (AIM)	<u>14%</u>
Combined Equity	63%
Real Estate	10%
Inflation-Linked (ILAC)	5%
Cash	<u>2%</u>

TOTAL PORTFOLIO 100%

Alternative Classification

Income-Fixed Income	16%
Growth-Public Equity	49%
Growth-Private Equity	14%
Real-Real Estate	10%
Real-Infrastructure & Forestland	3%
Inflation – Inflation-Linked	3%
Inflation – Commodities	1%
Liquidity – Treasuries	<u>4%</u>

TOTAL PORTFOLIO 100%

Totals by Classification

Income	16%
Growth	63%
Real	13%
Inflation	4%
Liquidity	<u>4%</u>

Total Portfolio 100%

Portfolios with the same expected return & similar risk

ASSET CLASSIFICATIONS & CHARACTERISTICS

Asset Class	Macro Risk Exposure			Characteristics				
	Economic Growth	Inflation	Interest Rates	Return - Cash Yield	Return - Appreciation	Liquidity	Inflation Protection	Leverage Present
Global Equity (GE)	H	H	M	L	H	H	L	M
Alternative Investment Management (AIM)	H	H	M	L	H	L	L	H
Global Fixed Income (GFI)	M	H	H	M	L	M	L	L
Real - Real Estate (RRE)	H	M	L	M	M	L	M	M
Real - Infrastructure (RI)	M	M	M	M	M	L	M	H
Real - Forestland (RF)	M	M	M	M	M	L	M	M
Liquidity - Treasury (LT)	L	H	H	M	L	H	L	N
Inflation - TIPS (ITIPS)	L	L	H	L	L	M	H	N
Inflation - Commodities (IC)	H	L	M	L	L	M	H	N
L: Low / M: Medium / H: High / N: Nil								

Rationale for Alternative Classification

- Attempts to group assets according to fundamental macro risks and return drivers (Economic Growth, Inflation, Interest Rates)
- Creates a framework for diversification across macro risks and economic regimes
- Creates a framework for hedging portfolios (Liability and Inflation) should that approach be selected in the future
- Creates a framework for dynamic strategic allocation (annual review) as opposed to long-term static policy allocations
- Will enable levered bond strategy should that be considered

Growth: Public Equities

The role of equities is total return oriented and to capture the equity risk premium (ERP), defined as the excess return over risk-free Government Bonds, by means of ownership risk in companies and exposure to corporate earnings growth. The major driver is appreciation, with some cash yield.

(Growth Risks, Liquid)

Growth: Global Equity – Implications

- Increase exposure to market inefficiency and trading
 - Dependent on ability to reliably identify anomalies
 - Hindered by large capital base
- Increase exposure to faster economic growth
 - Sensitive to valuation and timing

Growth: Global Equity – Return Sources (Arnott 9/2010)

	1982 - 2010	2010 – 2015?
Income	2.9%	2.4%
Growth		
Earnings	1.5%	1.5%
Inflation	3.1%	2.0%
Valuation	4.4%	0.0%
Total Return	10.6%	5.9%

- ❖ P/E expansion tremendous source of return 1982 -> 2010 period
- ❖ Repeat?

Growth: Global Equity – Emphasize Growth?

	FTSE All World, All Cap	IMF* 2010 GDP	GDP x Growth**
	Weight	Weight	Weight
Domestic:			
United States	43.1%	23.6%	18.1%
International:			
Developed	46.0%	41.5%	25.9%
Emerging	10.9%	27.0%	45.7%
Frontier***	0.0%	7.9%	10.3%
Total	100.0%	100.0%	100.0%

*IMF - International Monetary Fund ; **Growth - 5 year IMF estimates; ***Frontier - 136 non-FTSE countries

Growth: Global Equity – Emphasize Growth?

	FTSE All World, All Cap	IMF* 2010 GDP	GDP x Growth**
	Growth Contribution	Growth Contribution	Growth Contribution
Domestic:			
United States	1.8%	1.0%	0.8%
International:			
Developed	1.8%	1.4%	1.0%
Emerging	0.9%	2.5%	4.6%
Frontier***	0.0%	0.6%	0.9%
Total	4.6%	5.6%	7.3%

*IMF - International Monetary Fund ; **Growth - 5 year IMF estimates; ***Frontier - 136 non-FTSE countries

Growth: Private Equity (AIM)

Private equity is similar to public equity in many respects except there is additional risk associated with concentrated ownership, higher leverage and lack of liquidity. Private equity allocations are a means of enhancing equity returns through a value added approach to investment management of a diverse set of portfolio companies. The major driver for returns is appreciation, with negligible cash yield.

(Growth Risks, Illiquid)

Growth: AIM

Implications

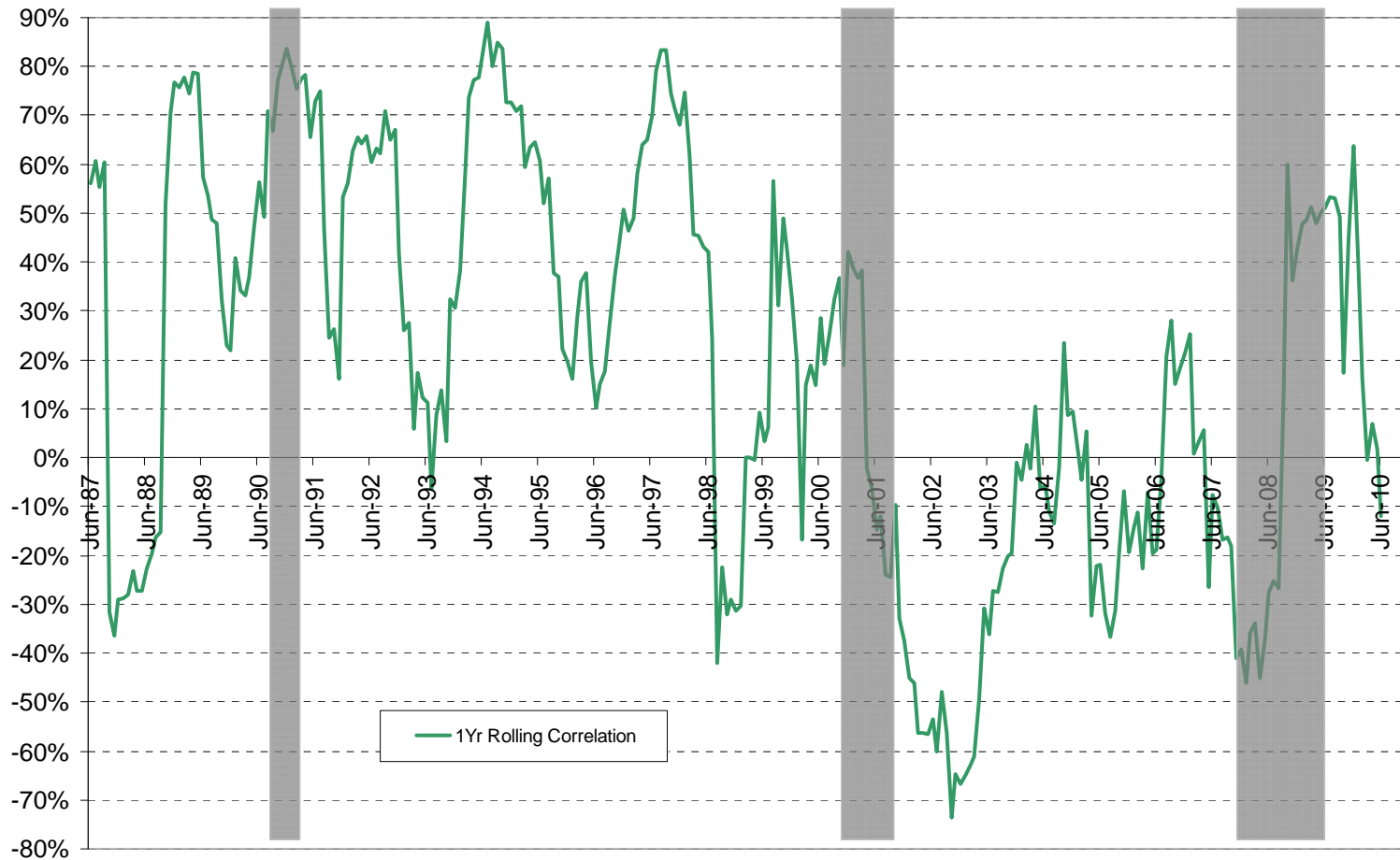
- Emphasis on market and asset inefficiencies
- Control-oriented and/or active management of a wide variety of investments designed to generate alpha
- Focus on growth and restructuring opportunities

Risks

- Sub-optimal investment manager selection
- Leverage at AIM portfolio company level may negatively impact returns during periods of slow economic growth
- Unstable capital markets will effect liquidity of portfolio
- Lack of resources to appropriately manage sizable portfolio and access best opportunities around the world

Forecast annual commitments between \$3-5B over next three years to maintain allocation within policy

Rolling Correlations between Fixed Income Benchmark and S&P 500



Distributed at the workshop on 11/8/10

Income: Global Fixed Income

The role of fixed income is to serve as a diversifier for the market risk entailed by equity exposures and to be a reliable source of income.

(Income Return, Growth Risks, Liquid)

Income: Global Fixed Income

- Generates Income
- Has low correlation with Global Equity
- Has lower risk profile due to the new policy
- Provides protection during times of market distress

Income: Liquidity/Treasuries (Government Bonds)

Treasury bonds exhibit safety and capital preservation properties as well as being an effective risk hedge during financial crisis. The role of this bucket is to be:

- a hedge for draw down risk entailed by significant equity exposures
- to be a reliable source of Income
- a partial hedge liability hedge (duration)
- a Liquidity source

(Hedge Market Risks, Duration Risks, Deflation Risks, Liquid)

Real: Real Estate

Since the equity allocation in the CalPERS portfolio is high and the risk contribution from Equities is even higher, the role of Real Estate in the CalPERS portfolio should be stable Income oriented, moderately levered, low risk, and low correlation with Equities. Hence, this role would be to have ownership risk in real property with stable cash yields. The major driver is Income, of which the majority is cash yield. Capital appreciation is an added, but lower source of return. Real Estate is also a partial Inflation hedge.

(Income Return, Long Term Inflation, Growth Risks, Illiquid)

Real: Real Estate – Practical Result

- Continued emphasis on private real estate:
 - Private real estate has a lower correlation to equities than public real estate
- More emphasis on income producing assets:
 - Fewer development projects
 - Focus on delivering and measuring cash yields
 - Current Benchmark does not report cash yields
- Less leverage:
 - Extensive use of leverage in opportunistic risk category increases exposure to higher risk, more volatile assets
- Implementation timeline:
 - Due to the size of the CalPERS Investment Portfolio as well as the illiquid nature of private market real estate assets, the period of time necessary to shift the existing portfolio to the new strategic portfolio will extend several years

Real: Infrastructure

- Infrastructure is a class of Private Equity investments with distinctive, defensive properties
- Infrastructure plays a strategic role within the Total Fund by providing:
 - *Steady Returns and Cash Yields* – regulated and long-term contracted operating revenues and returns ensure steady investment returns and cash yields
 - *Defensive Growth* – essential and non-competitive nature of infrastructure assets insulates returns against demand (Growth) risks
 - *Inflation Protection* – presence of direct and indirect inflation-linkages serve to preserve asset values
 - *Diversification Benefits* – Private Infrastructure is expected to demonstrate low correlation to Fixed Income and listed equities
- Return components, Cash Yield and Growth, are expected to be roughly equal

(Stable Returns and Cash Yields, Defensive Growth, Inflation Protection, Diversification, Illiquid)

Real: Infrastructure - Implications

- Asset Selection
 - Focus on asset level idiosyncratic risks
 - Mitigate agent-related “style drift”
- Capital Deployment
 - Control deployment of capital
 - Secure liquidity rights
 - Manage hold periods
- Governance
 - Stress strong affinity and alignment with investment partners
 - Maintain effective control of influence for strategic priorities

Real: Forestland

- Forestland investments are long-term investments, generally made through private investment vehicles
- Underlying return drivers include: biological growth, timber prices, land values and management strategies
- Cash Yields – from sales of harvested timber – depend on the maturity of the forestland properties, and timber prices (which vary with economic growth)
- Economic growth-related risks are balanced against inherent defensive qualities including the tangible nature, biological growth and scarce supply of forestland resources
- Primary portfolio benefits from Forestland investments include
 - *Inflation Protection* – due to positive, long-term correlation with Inflation
 - *Diversification Benefits* – due to low correlation to other asset classes
- Return components, Cash Yield and Growth, are expected to be roughly equal over a full economic cycle

(Inflation Protection, Diversification, Illiquid)

Real: Forestland - Implications

- Capital Deployment
 - Allocation is presently fully invested
 - Investment vehicles managed by external forestland experts
- Portfolio Management
 - Exercise oversight and influence in regard to management of major risks and liquidity
 - Act to ensure capitalization structures will withstand economic cycles

Inflation: Inflation-Linked Bonds (ILBs)

The role of ILBs is to provide a direct hedge against inflation

- Liquid as it consists of public-traded securities only (e.g., TIPs and Global Linkers)
- Unlevered
- Provides a liability hedge

Inflation: Commodities

Our commodities portfolio is unlevered. The role of this portfolio is to provide:

- strong, though inconsistent, hedge against inflation
- low to moderate but very volatile return and
- low Income yield

Open Discussion

Committee Decision on Alternative Asset Classification

Committee Members

November 8, 2010

Staff seeks approval of Committee for Alternative Asset Allocation Classification

Liabilities

Alan Milligan
Chief Actuary
CalPERS

November 8, 2010

Key Points

- Nature of Our Liabilities
- The Funding Process
- What to Expect for Employer Contribution Rates
- Modeling and Its Limitations
- The Discount Rate
- Future Changes to the Process

Nature of Our Liabilities

- Stream of Benefit Payments
- Uncertain
- Sensitive to Economic Conditions
- Differs by Employer, Plan and Tier
- Risk Pooling

Stream of Benefit Payments

- Each Benefit is Either:
 - A Stream of Payments Made over Many Years
 - Retirement Benefit
 - Lifetime Survivor's Benefit
 - A Lump-sum Payment
 - Refund of Contributions
 - Lump-sum Death Benefit
- Add These Together
 - Result is a Stream of Payments

Uncertain

- Benefit Payments are Uncertain
 - Timing
 - Retirement Date
 - Pre-retirement Death
 - Amount
 - Final Compensation
 - Option Elected
 - Duration
 - Mortality
 - Spousal Survivorship

Sensitive to Economic Conditions

- Amount of Benefits
 - Based on Salary Level
 - Partially Inflation Protected
- Timing of Benefit Payments
 - Retirements Affected by Economic Conditions
- Liability Calculation
 - Discount Rate
 - Inflation Assumption

Differs by Employer, Plan and Tier

- Impact of Investment Results Varies
 - Safety vs. Miscellaneous
 - Ratio of Active to Retired
 - Level of Benefits
- New Tiers of Benefits
 - More Common Now than Before

Risk Pooling

- Shares Demographic Risk
- Every Plan Gets the Same Investment Results
 - But There Is Some Sharing
 - Pooled Investment Gains/Losses Amortized over Payroll
 - Equitable If Asset to Payroll Ratio Is Similar

The Funding Process

- Actuaries Determine Total Required Contribution
 - Level Percent of Pay
 - Based on Expected Return
 - Slightly Conservative
- Subtract Expected Member Contributions
- Remainder is Paid by Employer
- Amount Re-determined Each Year

Impact of Investment Return on Funding

- Generally 75% of Income is From Investment Return
- Remaining 25% is Split Between Member and Employer Contributions
- Member Contributions Generally Fixed
- This Leverage Makes Employer Contributions Very Sensitive to Investment Returns

Sensitivity of Employer Contributions

- Asset to Payroll Ratios
 - Generally 4 to 6 for Miscellaneous Plans
 - Generally 6 to 10 for Safety Plans
- A 10% Investment Loss is Equal to
 - A Loss of 40% to 60% of Payroll for a Miscellaneous Plan
 - A Loss of 60% to 100% of Payroll for a Safety Plan
- We had a 24% Loss in 2008-09

What to Expect for Employer Rates

- Expected to Increase
 - Because of the Asset Loss in 2008-09
 - Smoothing has Delayed the Increase
- Differs By Plan
 - Safety vs. Miscellaneous
 - Plan Formula
 - Ratio of Actives to Retirees

Estimated Increases Over the Next Few Years

Estimated Increase in Employer Rate (% of Payroll)

	2012-13	2013-2014	2014-15
Public Agency Miscellaneous	0.4% to 0.6%	1.8% to 2.8%	0.3% to 0.4%
Public Agency Safety	0.6% to 0.8%	3.0% to 4.3%	0.4% to 0.5%

- The (24%) investment loss in 2008-2009 will continue to cause employer rates to increase
- Increases continue beyond 2014-2015, gradually reducing

Modeling and Its Limitations

- A Model Is a Simplified Representation of a Complex Process
 - Very Complex Systems Require Complex Models
 - There is a Trade Off between Simplicity and Complexity
- Optimizers Tend to Find Weaknesses in the Model
- Poorly Chosen Parameters Give Poor Results

Complexity Vs. Simplicity

Complex Models:

- Hard to Understand
- Increased Chance of Error
- More Overhead
- Less Flexible
- More Accurate

Simple Models:

- Easier to Understand
- Less Chance of Error
- Less Overhead
- More Flexible
- Less Accurate

Simplifications

- Can be Essential for a Workable Model
- Need to Understand Some of the Key Simplifications
 - Essential to Understanding the Limitations of the Model
 - Be Aware of How They Will Impact Results
- Would Like to Draw Attention to Three Key Points

Simplifications

- PERF Modeled as One Plan
 - Actual plans vary
 - Funded Status and Contribution Rates
 - Asset to Payroll Ratios
 - Result of Simplification
 - Model will Overstate Contribution Rates and Volatility for Miscellaneous Plans
 - Model will Understate Contribution Rates and Volatility for Safety Plans

Simplifications

- Fixed Discount Rate
 - All Modeling Done with a 7.75% Discount Rate
 - Likely to Recommend a Lower Discount Rate
 - Different Candidate Portfolios Have Different Returns
 - Result of Simplification
 - Model Will Understate Contribution Rates (Discussed Later)
 - Model Will Understate the Increase in Contribution Rates for Portfolios with Lower Returns

Simplifications

- Ten Year Model
 - All Decision Factors Evaluated at Ten Year Mark
 - Tied to the Expected Return over Next Ten Years
 - Result of Simplification
 - Model may Understate the Volatility
 - Because of Asset Smoothing and Actuarial Policies

The Discount Rate

- Current Discount Rate is 7.75%
- Based on an Assumed Return of 8.04% (Net of Admin Expenses)
- 0.29% Provision for Adverse Deviation (Conservatism)
- Where Are We Now?

Where Are We Now?

If the Board does not Change the Policy Asset Allocation:

Assumed Return for First Ten Years	7.37%
Assumed Return after Ten Years	8.05%
Equivalent Single Rate	7.82%
Margin for Admin Expenses	(0.15%)
Expected Net Return on Assets	7.67%
Provision for Adverse Deviation	0.29%
Equivalent Discount Rate	7.38%

What To Expect

- Depending on the Outcome of the ALM Workshop
 - Likely to Recommend a Discount Rate of 7.5% or 7.25%
 - This Will Be Brought to the Board in February 2011
- What Will This Do To Employer Rates?

Changing the Discount Rate Assumption

Estimated Increase in Employer Rate (% of Payroll)

	Discount Rate	
	7.50%	7.25%
State Miscellaneous	2.3%	4.8%
State Industrial	2.0%	4.1%
State Safety	1.7%	3.6%
POFF	3.3%	6.8%
CHP	3.8%	7.8%
Schools	1.9%	3.9%

Changing the Discount Rate Assumption

Estimated Increase in Employer Rate (% of Payroll)

	Discount Rate	
	7.50%	7.25%
Public Agency Miscellaneous	1.5% to 3.0%	3.5% to 6.0%
Public Agency Safety	3% to 5%	6% to 10%

- Impacts State Plans and Schools Pool in 2011-2012
- Impacts Public Agency Plans in 2012-2013

Combined Effect

- The Increases Above are in Addition to Increases Due to Asset Loss in 2008-09
- If We End Up at 7.25% Discount Rate
 - Public Agencies Should Expect to See Increases Over the Next Three Years of
 - 6% to 10% of Payroll for Miscellaneous Plans
 - 10% to 16% of Payroll for Safety Plans

Future Changes to the Process

- Risk Based
 - Result will be Both a Risk Budget and an Asset Allocation
 - Should Lead to a More Nimble Asset Allocation
- More Frequent
 - ALM Workshop & Risk Budget at Least Biennially
 - Asset Allocation Reviews Annually or As Needed
- Feedback Loop on Discount Rate
 - Discount Rate Reflects Expected Return on Policy Portfolio

Future Changes to the Process

- Two Plans Instead of One Plan
 - Show Impact on Safety Plans Separate from Misc. Plans
- Longer Decision Time Horizon
 - Current Decision Horizon is Less than the Asset Smoothing Period

Things To Keep In Mind

- Employer Contributions are Very Sensitive to Investment Returns
- Contributions are Increasing
- The Model Likely Understates Volatility for Safety Plans
 - May Understate Volatility for All Plans
- A Discount Rate Change is Likely to Increase Contributions Further

Questions?

Decision Factors: How Portfolio Choice Impacts Contribution Rates and Fund Status

Bob McCrory, FSA, EFI Actuaries
Richard Roth, CalPERS, Risk Management

November 8, 2010

Key Points

- Briefly summarize the overall process
- Decision Factors
 - Conceptual approach
- Application of Decision Factors
 - Definition
 - Economic regimes
 - Scoring process

Overall Process

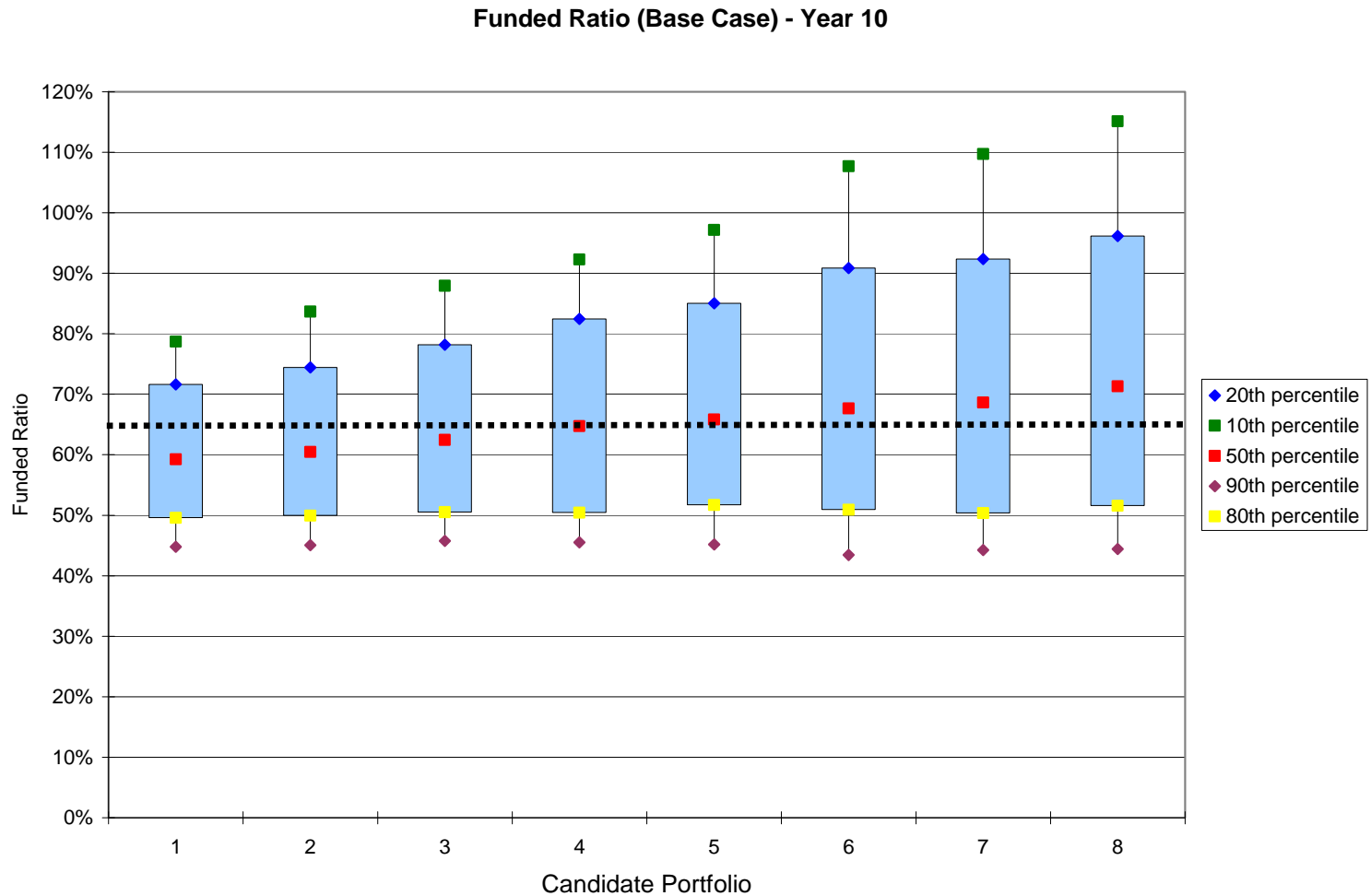
- Actuarial Modeling
 - Build a comprehensive model of the PERF
 - All 2,000+ plans represented
- Measurement
 - Measure performance of PERF with different candidate portfolios
 - Use 1,000 simulated outcomes for each candidate portfolio to measure uncertainty
 - Calculate resulting employer contribution rates and funded ratios and use to measure Decision Factors
- Selection Process
 - Board members select preferred candidate portfolios by assigning weights to the Decision Factors

Overall Process

- The simulated outcomes are designed to reflect actuarial practice
 - A smoothing mechanism acts as a shock absorber to spread the impact of very high and very low investment returns across many years
 - The employer contribution rate is recalculated each year based on the prior year funded ratio
- For this workshop, however, we need clear visibility of the more immediate effect of low investment returns on the health of the plan
 - Funded ratio is based on market value of assets instead of actuarial value
 - Additional efforts are made to model the negative effect of low investment returns

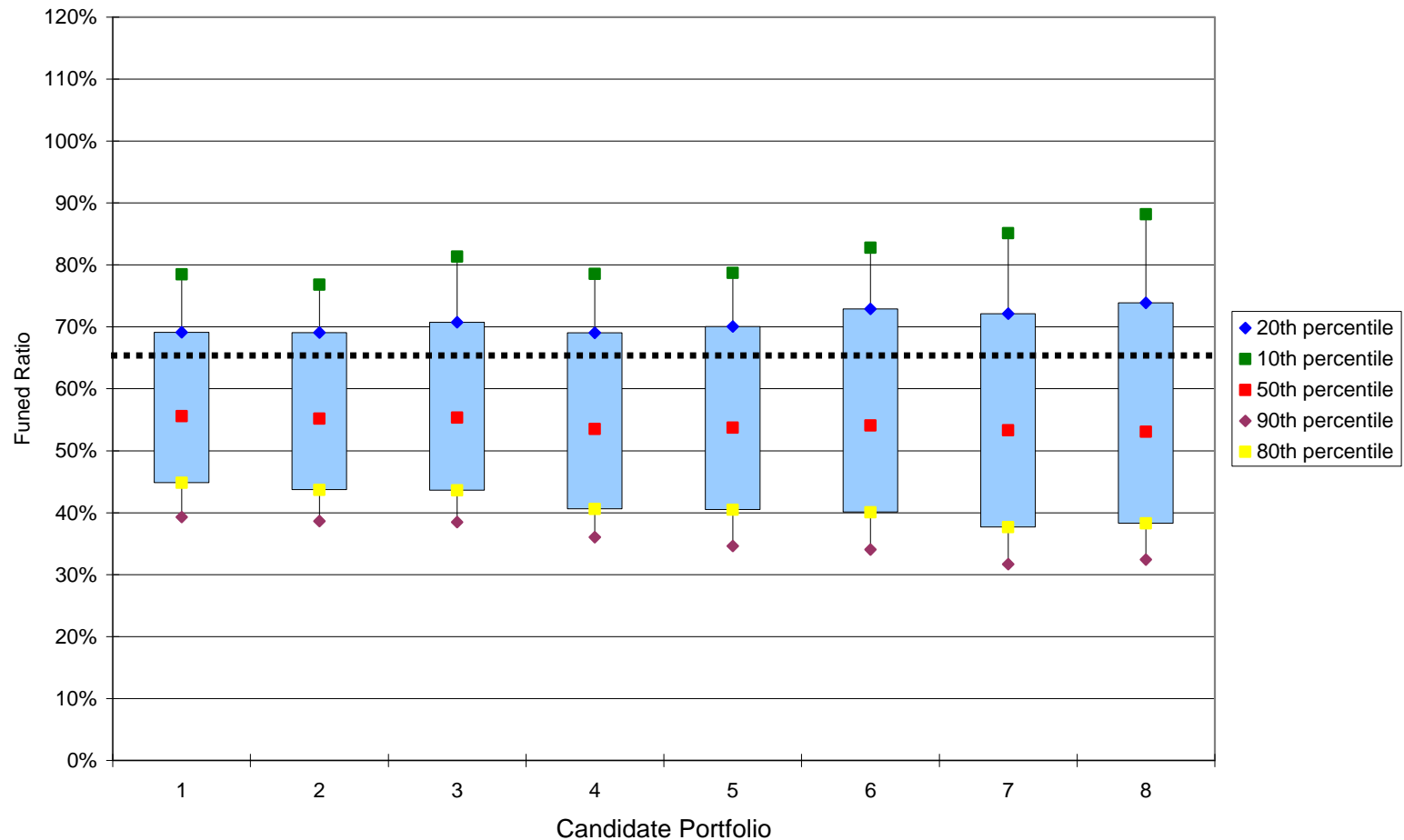
Overall Process

- CalPERS staff has developed two return distributions to be used in calculating simulated outcomes
 - Base case return distribution is based on a longer return series capital market assumptions presented June 2010
 - 30% weak growth return distribution recognizes the likelihood of low return economic regimes.
- The effect of using a low return distribution (30% weak growth case) can be seen in the graphs of funded ratio and employer contribution rates



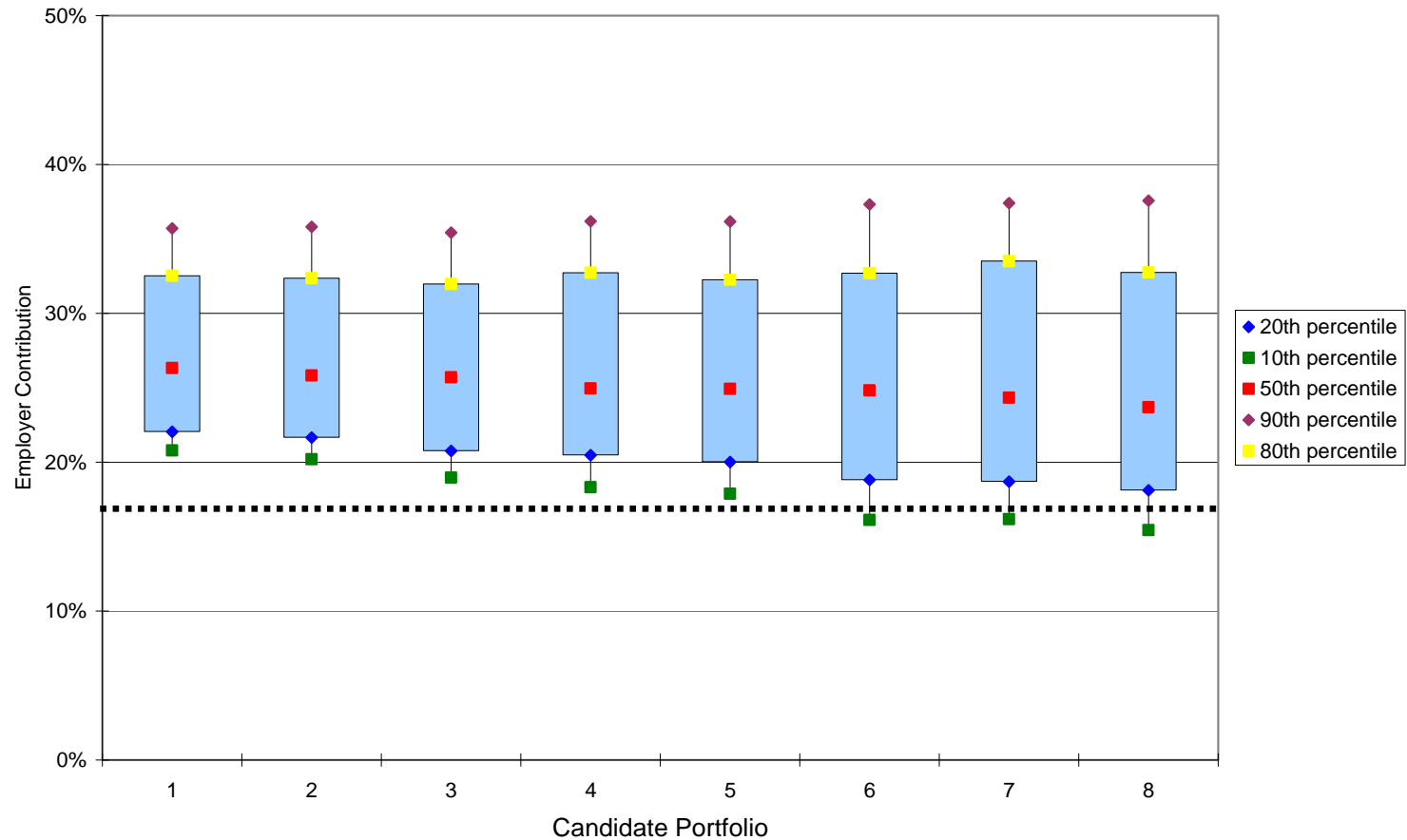
Comment – Funded ratio at 90th percentile is limited to approximately 45% on the downside for all candidate portfolios

Funded Ratio (30% Weak Growth Case) - Year 10

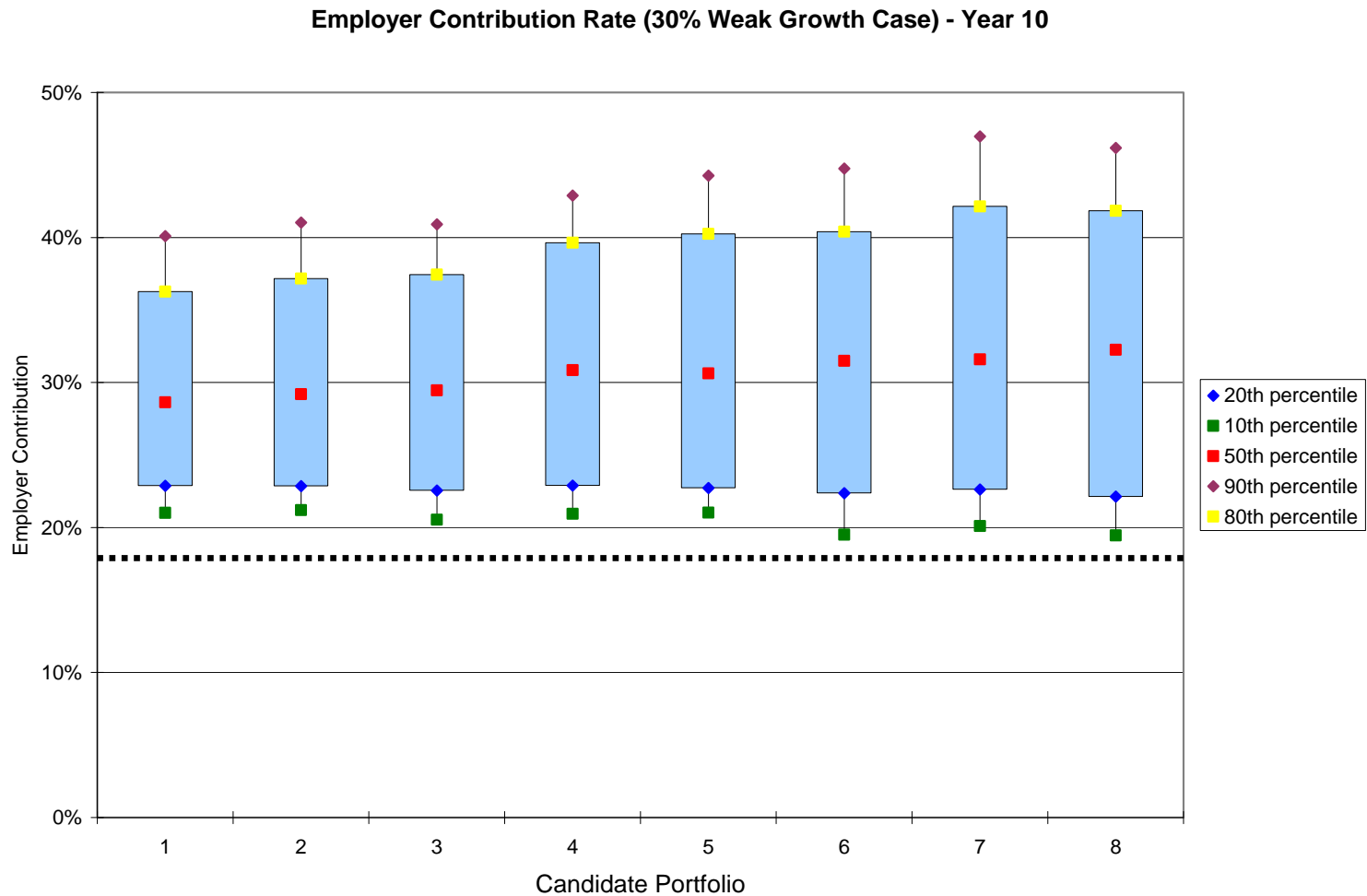


Comment – Funded ratio at 90th percentile is approximately 30% on the downside for more aggressive candidate portfolios

Employer Contribution (Base Case) - Year 10



Comment – Employer contribution rate at 90th percentile is limited to approximately 37% on the upside for all candidate portfolios.



Comment – Employer contribution rate at 90th percentile is limited to approximately 45% on the upside for more aggressive candidate portfolios.

Decision Factors

- Conceptual Approach
 - We need to use this information about funded ratios and employer contribution rates to construct Decision Factors
 - Decision Factors allow decision makers to define and quantify their tolerance for risk using intuitive metrics, allowing Boards to easily establish a consensus risk tolerance
 - Based on common sense measures of risk
 - Help determine where on Efficient Frontier we should be

Decision Factors

- Conceptual Approach
 - Four decision factors in two pairs
 - Address two key issues:
 - Funding level
 - Cost
 - Each pair couples risk with reward
 - Each Decision Factor is a combination of two components:
 - A variable that describes the financial condition of the plan
 - A threshold level (or goal) for that variable

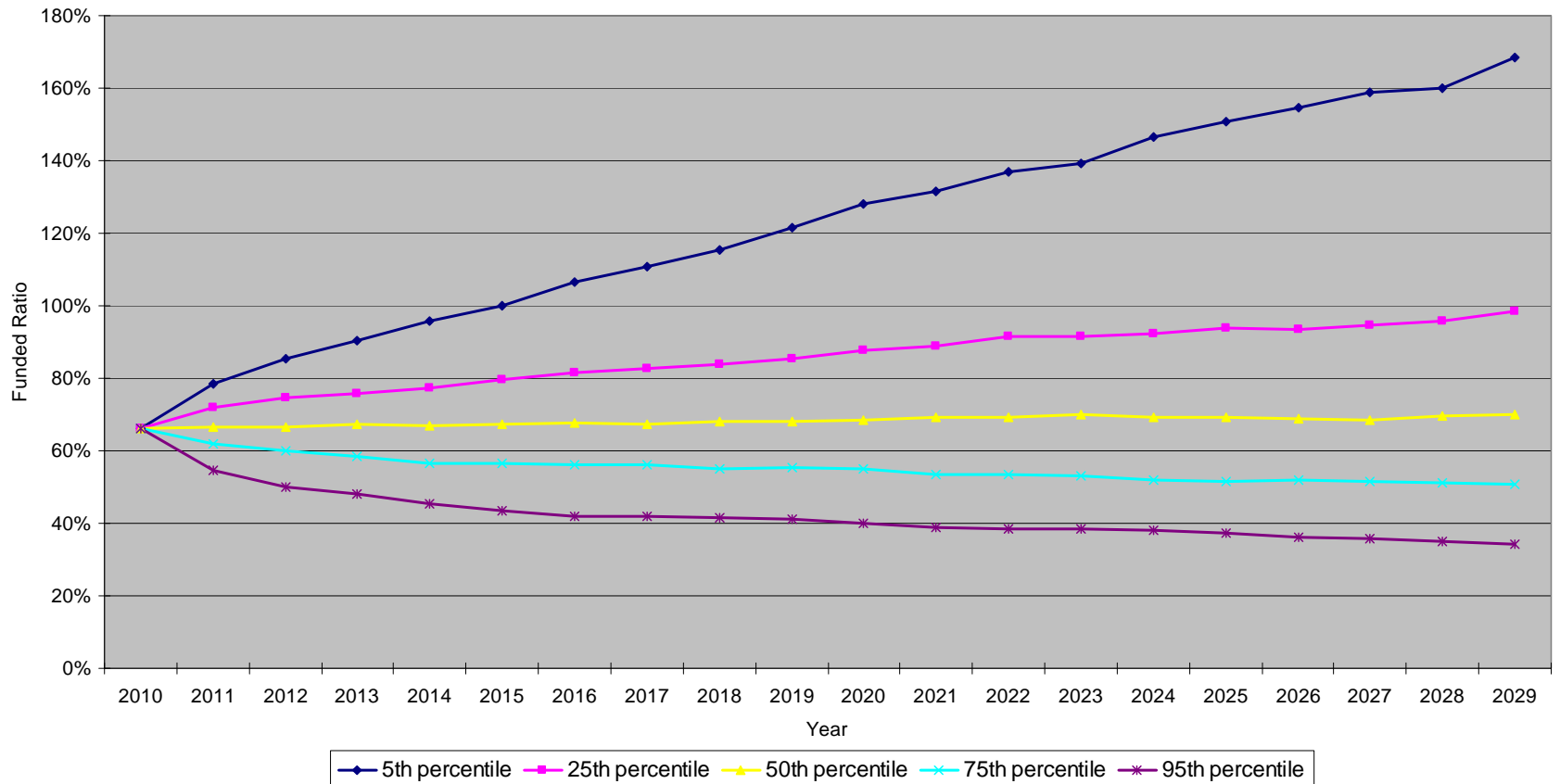
Decision Factors

- In general terms, specific decision factors can be characterized as follows:
 - *Achieve a Funding Goal*
 - *Avoid a Funding Shortfall*
 - *Minimize Contributions*
 - *Avoid Contribution Surprises* (i.e., manage contribution volatility)

Application of Decision Factors

- Bob described the simulations of funded ratios and employer contribution rates as of 10 years into the future
- The following graphs show the simulations of funded ratios and employer contribution rates for the next 19 years (2011-2029) using the base case distribution for the current policy portfolio

Percentiles of Expected Funded Ratios Based on the Current Policy Portfolio (Base Case)



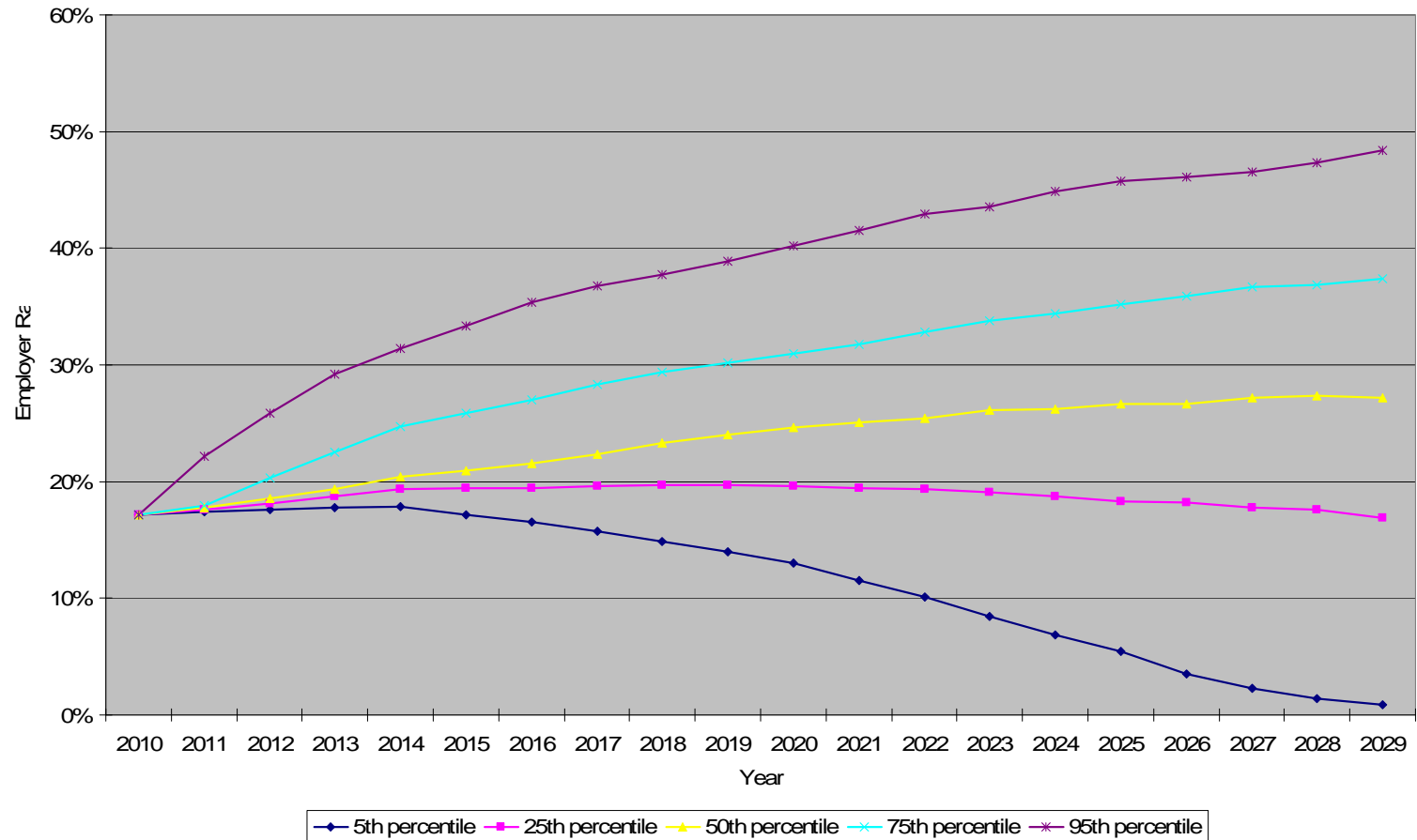
Comment

Probability of the plan being fully funded (100% or higher) in 19 years is 25%.

Probability of the plan being 70% funded or higher in 19 years is 50%

Current policy portfolio assumes a return of 7.4% and is estimated to make limited actuarial progress

**Percentiles of Expected Employer Rates Based on the Current Policy Portfolio
(Base Case)**



Comment

Probability of employer contribution rates being lower than they are now in 19 years is 25%

Probability of employer contribution rates being 27% or higher in 19 years is 50%

Application of Decision Factors

- We are using the following Decision Factors based on 1 standard deviation increase and decrease from their mean values at year 10

Funding Level Related Decision Factors		
DF1	Improve Funding	Funded ratio is to improve to 90% at the end of 10 years
DF2	Avoid Low Funding	Funded ratio is to above 38% at the end of 10 years
Cost Related Decision Factors		
DF3	Minimize Employer Contributions	The average employer contribution is to be below 19% at the end of 10 years
DF4	Stabilize Employer Contributions	The average employer contribution is to not increase above 40% at the end of 10 years

Application of Decision Factors

Change from prior years

- In prior years one return distribution was used to measure all Decision Factors
- This year we use two return distributions: one (base case) to measure Decision Factors 1 and 3 (return focused) and another (30% weak growth case) to measure Decision Factors 2 and 4 (risk focused).
 - Base case return distribution is based on capital market assumptions presented June 2010
 - 30% weak growth return distribution is based on 30% likelihood of recession in any given year and is designed to recognize the likelihood of low return economic regimes
 - 30% weak growth distribution is also designed to introduce non normally distributed returns

Application of Decision Factors

- Economic regimes have been evident over the last 40 years and have a significant effect on equity returns in particular
- Low return regimes were experienced in two out of the last four decades (1970's and 2000's)
- CalPERS has more recently had an equity centric investment profile and is therefore vulnerable to these regimes
- We are here today to review our current allocation and consider changes

Portfolio Selection Criteria - Preview

Richard Roth

Jay Jeong

November 8, 2010

Application of Decision Factors – Overview of Selection Process

For each candidate mix:

- Calculate a set of Decision Factor Scores
- Multiply the Decision Factor Scores and Board Consensus Weight for each Decision Factor resulting in a Preference Score

Rank the candidate mixes based on the Preference Scores

Selection Process ends when Board reaches consensus on:

- Decision Factor Weights
- Candidate mix ranking

Decision Factors - Reminder

- Decision Factor 1 : Improve Funding Level
 - Funded Ratio is to improve to 90% at the end of 10 years
- Decision Factor 2 : Avoid Deterioration in Funding Level
 - Funded Ratio is to stay above 38% at the end of 10 years
- Decision Factor 3 : Minimize Employer Contribution Rate
 - The average Employer Contribution Rate is to be below 19% at the end of 10 years
- Decision Factor 4 : Stabilize Employer Contribution Rate
 - The average Employer Contribution Rate is to not increase above 40% at the end of 10 years

Decision Factor Weights

Funding Level		Employer Contribution Rate	
DF1 Vote (weight)	5% - 45%	DF3 Vote (weight)	5% - 45%
DF2 Calculated	45% - 5%	DF4 Calculated	45% - 5%
Total (DF1 + DF2)	50%	Total (DF3 + DF4)	50%

Grand Total = 100%

Please select a weight (1-9) for Decision Factor 1

Decision Factor 1 Voting Button	Decision Factor 1 Assigned Weight	Decision Factor 2 Calculated Weight
1	5%	45%
2	10%	40%
3	15%	35%
4	20%	30%
5	25%	25%
6	30%	20%
7	35%	15%
8	40%	10%
9	45%	5%

Please select a weight (1-9) for Decision Factor 3

Decision Factor 3 Voting Button	Decision Factor 3 Assigned Weight	Decision Factor 4 Calculated Weight
1	5%	45%
2	10%	40%
3	15%	35%
4	20%	30%
5	25%	25%
6	30%	20%
7	35%	15%
8	40%	10%
9	45%	5%

Asset Liability Management Workshop

November 9, 2010

Overview

Day 2

Joseph Dear
Chief Investment Officer,
CalPERS

Agenda for Today

- Candidate Portfolios, Risk/Return Characteristics and Portfolio Attributes
- *Portfolio Selection by Committee*

Candidate Portfolios Characteristics & Attributes

Ray Venner
Portfolio Manager
Asset Allocation

November 9, 2010

Return Forecasts: Alternative Classification

Forecast Expected Values and Volatilities of Returns

	Compound Return	Volatility	Arithmetic Return	Min	Max
Fixed Income	3.75%	6.50%	3.95%	15%	100%
Public Equity	7.75%	16.00%	8.93%	0%	100%
Private Equity (AIM)	9.00%	26.00%	12.06%	0%	14%
Real Estate	7.00%	14.00%	7.91%	0%	10%
Infras. & Forestland	7.00%	10.00%	7.47%	1%	3%
Inflation Linked Bonds	3.50%	6.00%	3.67%	1%	3%
Commodities	5.00%	21.00%	7.08%	0%	1%
Liquidity (Treasuries)	3.25%	6.20%	3.44%	4%	100%

Source of returns & volatilities of Fixed Income, Public Equity, Private Equity, and Real Estate = Sept. 2010 IC memo

Source of returns & volatilities of other investments = CalPERS Staff

Source of investment min. and max. = CalPERS staff based on investability and preference for gradual changes

Forecast Correlations

	Fixed Income	Public Equity	Private Equity (AIM)	Real Estate	Infras. & Forestland	Inflation Linked Bonds	Commodities
Fixed Income	1.00						
Public Equity	0.10	1.00					
Private Equity (AIM)	0.10	0.80	1.00				
Real Estate	0.15	0.35	0.25	1.00			
Infras. & Forestland	0.25	0.45	0.35	0.40	1.00		
Inflation Linked Bonds	0.55	0.00	0.00	0.18	0.15	1.00	
Commodities	0.00	0.10	0.05	0.23	0.20	0.20	1.00
Liquidity (Treasuries)	0.92	0.10	0.10	0.15	0.20	0.60	0.00

Baseline Candidate Portfolios

Forecast Annual Nominal Return	A1	A2	A3	A4	A5	A6	A7	A8
Compound return	6.00%	6.25%	6.50%	6.75%	7.00%	7.25%	7.38%	7.49%
Volatility	7.59%	8.20%	8.90%	9.66%	10.50%	11.41%	11.92%	12.51%
Average return	6.27%	6.57%	6.87%	7.19%	7.52%	7.85%	8.04%	8.21%
Investment Policy Weighting								
INCOME - Fixed Income	46.8%	42.21%	37.5%	32.6%	26.5%	19.7%	15.9%	15.0%
GROWTH - Public Equity	25.6%	28.03%	30.5%	33.1%	38.5%	45.3%	49.1%	53.1%
GROWTH - Private Equity	6.6%	8.76%	11.0%	13.3%	14.0%	14.0%	14.0%	14.0%
REAL - Real Estate	10.0%	10.00%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
REAL - Infras. & Forestland	3.0%	3.00%	3.0%	3.0%	3.0%	3.0%	3.0%	2.9%
INFLATION - Inflation Linked Bonds	3.0%	3.00%	3.0%	3.0%	3.0%	3.0%	3.0%	1.0%
INFLATION - Commodities	1.0%	1.00%	1.0%	1.0%	1.0%	1.0%	1.0%	0.0%
LIQUIDITY - Treasuries	4.0%	4.00%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Asset Class Policy Weighting								
INCOME (Fixed Income)	46.8%	42.2%	37.5%	32.6%	26.5%	19.7%	15.9%	15.0%
GROWTH (Public & Private Equity)	32.2%	36.8%	41.5%	46.4%	52.5%	59.3%	63.1%	67.1%
REAL (Real Est./Infras./Forestland)	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	12.9%
INFLATION LINK. (ILBs, Commod.)	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	1.0%
LIQUIDITY (Treasuries)	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Sum	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

- Candidate portfolios are potential alternative policy portfolios
- Eight candidate portfolios are listed
 - From most conservative bond-centric A1 to the equity-dominant A8
 - Each portfolio is intended to be the least risky for its target return
 - A7 is very similar to the current policy portfolio
 - Investment assumptions and limits are listed in the prior slide

Candidate Portfolios with Different Constraints on Illiquid Assets

	Proxy of current portfolio	Private Equity ≤12% (vs. 14%)	Real Estate ≤8% (vs. 10%)	Private Eq. ≤12% & Real Est. ≤8%	Inflation Linked ≤10% (vs. 4%)	Private Equity ≤20% (vs. 14%)
Forecast Annual Nominal Return	A7	B1	B2	B3	B4	B5
Compound return	7.38%	7.37%	7.33%	7.32%	7.44%	7.39%
Volatility	11.92%	11.92%	11.92%	11.92%	11.92%	11.92%
Average return	8.04%	8.03%	7.99%	7.98%	8.10%	8.05%
INCOME - Fixed Income	15.9%	15.0%	17.3%	16.2%	15.0%	19.2%
GROWTH - Public Equity	49.1%	52.1%	49.7%	52.8%	48.9%	40.3%
GROWTH - Private Equity	14.0%	12.0%	14.0%	12.0%	14.0%	19.6%
REAL - Real Estate	10.0%	10.0%	8.0%	8.0%	10.0%	10.0%
REAL - Infrs. & Forestland	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
INFLATION - Inflation Linked Bonds	3.0%	2.9%	3.0%	3.0%	2.1%	3.0%
INFLATION - Commodities	1.0%	1.0%	1.0%	1.0%	3.0%	1.0%
LIQUIDITY - Treasuries	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
INCOME (Fixed Income)	15.9%	15.0%	17.3%	16.2%	15.0%	19.2%
GROWTH (Public & Private Equity)	63.1%	64.1%	63.7%	64.8%	62.9%	59.8%
REAL (Real Est./Infrs./Forestland)	13.0%	13.0%	11.0%	11.0%	13.0%	13.0%
INFLATION LINK. (ILBs, Commod.)	4.0%	3.9%	4.0%	4.0%	5.1%	4.0%
LIQUIDITY (Treasuries)	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Sum	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

- The forecast volatility is the same for each portfolio so the portfolios can be compared by expected returns
- Portfolios B1 & B5: Adjusting the upper limit of Private Equity has little effect on expected return given that private equity and public equity are assumed to be close substitutes
- B2: Reducing the cap on Real Estate more substantially reduces the portfolio expected return
- B4: Increasing the upper limit on inflation linked from 4% to 10% and of commodities from 1% to 3%, improves expected returns given the assumed low correlation between equities and commodities.

Candidate Portfolios with Bond Allocations Unconstrained

Forecast Annual Nominal Return	A7	F1	F2	F3	F4	F5	F6	F7	F8
Compound return	7.38%	6.00%	6.50%	7.00%	7.25%	7.50%	7.75%	8.00%	8.14%
Volatility	11.92%	7.55%	8.86%	10.43%	11.34%	12.34%	13.42%	14.60%	15.30%
Average return	8.04%	6.27%	6.87%	7.51%	7.85%	8.21%	8.58%	8.98%	9.21%
Fixed Income	15.9%	51.1%	41.8%	31.0%	24.2%	17.0%	12.2%	4.6%	0.0%
Public Equity	49.1%	25.5%	30.4%	38.0%	44.8%	52.0%	59.4%	67.4%	72.1%
Private Equity	14.0%	6.4%	10.8%	14.0%	14.0%	14.0%	14.0%	14.0%	14.0%
Real Estate	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Infras & Forestland	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Inflation Linked Bonds	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	0.4%	0.0%	0.0%
Commodities	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	0.9%
Liquidity (Treasuries)	4.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
INCOME (Fixed Income)	15.9%	51.1%	41.8%	31.0%	24.2%	17.0%	12.2%	4.6%	0.0%
GROWTH (Public & Private Equity)	63.1%	31.9%	41.2%	52.0%	58.8%	66.0%	73.4%	81.4%	86.1%
REAL (Real Est./Infras./Forestland)	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%
INFLATION LINK. (ILBs, Commod.)	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	1.4%	1.0%	0.9%
LIQUIDITY (Treasuries)	4.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Sum	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.00%

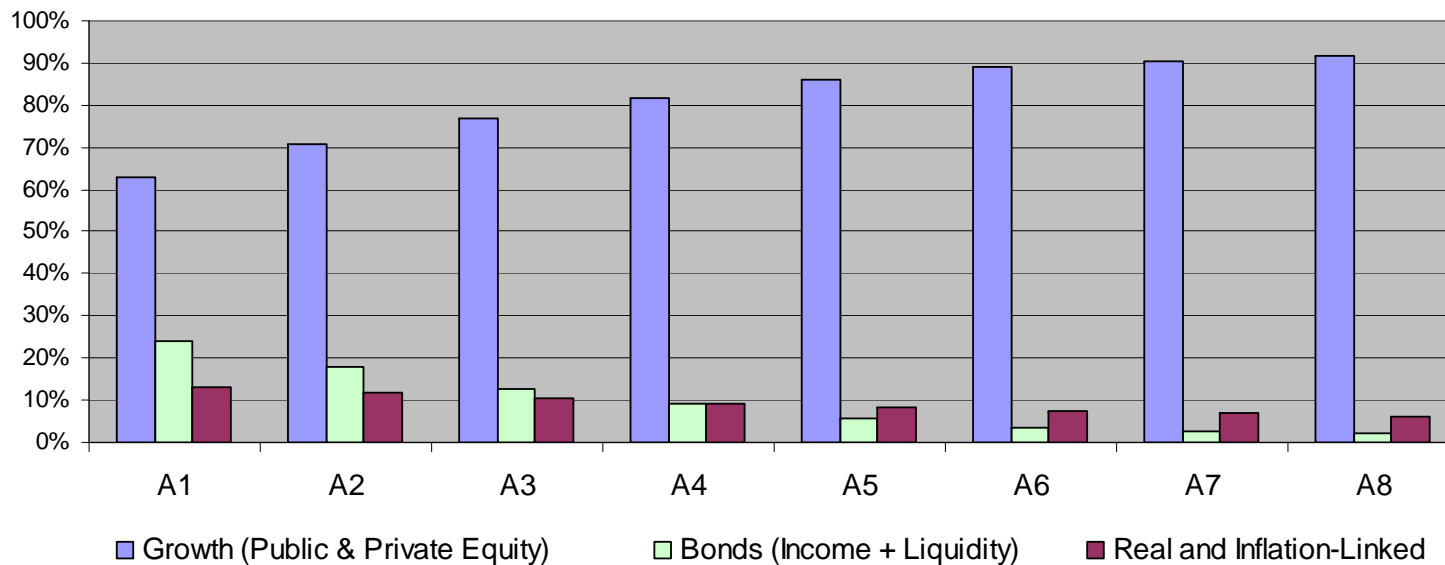
- For portfolios F1 – F8, the allocations to Fixed Income, Inflation Linked Bonds, and Liquidity (Treasuries) are all unconstrained
 - The other limits are unchanged
- F6, the portfolio with a 7.75% compound return, comprises 73% equity
 - 10 percentage points above current equity weight
 - 86% equity including Real and 13% bonds
- The Liquidity allocation is zero for all portfolios
 - Because the assumed compound return of Liquidity, 3.25%, is the lowest of all investments

Candidate Portfolios - Unconstrained

Forecast Annual Nominal Return	A7	U1	U2	U3	U4	U5	U6	U7
Compound return	7.38%	5.99%	6.50%	7.00%	7.51%	7.99%	8.50%	9.00%
Volatility	11.92%	5.93%	6.65%	7.49%	8.46%	9.64%	12.17%	17.78%
Average return	8.04%	6.16%	6.71%	7.27%	7.84%	8.42%	9.18%	10.44%
Fixed Income	15.9%	22.0%	18.5%	14.9%	5.9%	0.0%	0.0%	0.0%
Public Equity	49.1%	5.8%	4.6%	3.5%	2.2%	0.0%	0.0%	0.0%
Private Equity	14.0%	3.1%	5.4%	7.7%	10.4%	18.9%	35.3%	62.6%
Real Estate	10.0%	6.4%	8.7%	10.9%	13.1%	14.6%	15.3%	16.3%
Infras & Forestland	3.0%	25.7%	31.6%	37.5%	44.1%	43.8%	33.6%	16.6%
Inflation Linked Bonds	3.0%	20.9%	12.3%	3.7%	0.0%	0.0%	0.0%	0.0%
Commodities	1.0%	16.1%	19.0%	21.9%	24.3%	22.6%	15.8%	4.5%
Liquidity (Treasuries)	4.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
INCOME (Fixed Income)	15.9%	22.0%	18.5%	14.9%	5.9%	0.0%	0.0%	0.0%
GROWTH (Public & Private Equity)	63.1%	8.9%	10.0%	11.1%	12.5%	18.9%	35.3%	62.6%
REAL (Real Est./Infras./Forestland)	13.0%	32.1%	40.3%	48.4%	57.2%	58.5%	48.9%	32.9%
INFLATION LINK. (ILBs, Commod.)	4.0%	37.0%	31.3%	25.6%	24.3%	22.6%	15.8%	4.5%
LIQUIDITY (Treasuries)	4.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Sum	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.00%

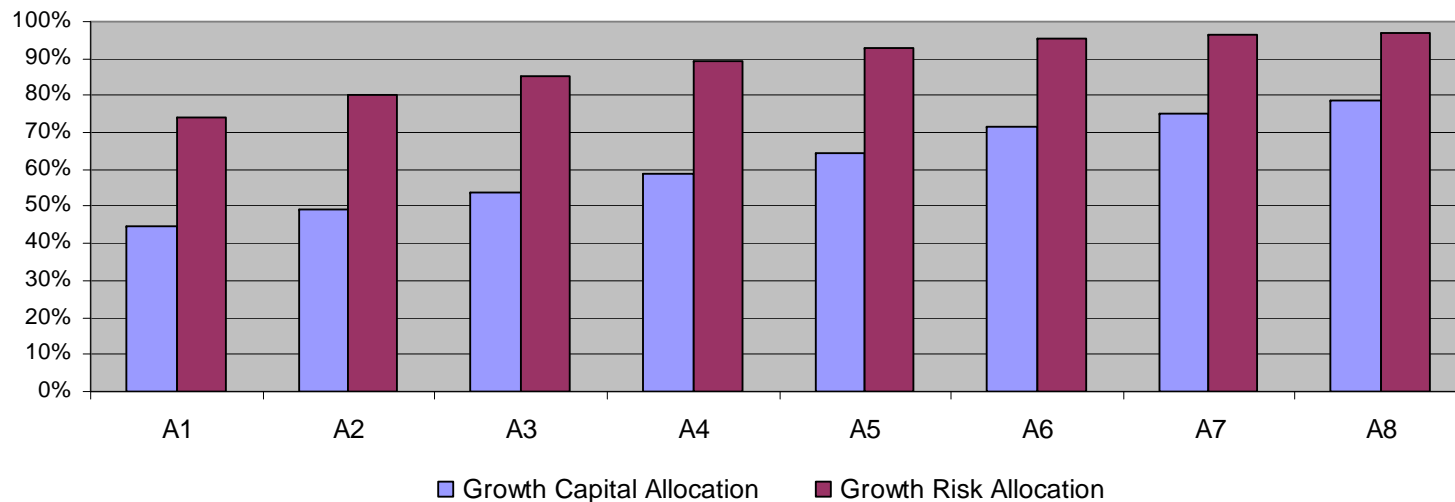
- For portfolios U1 – U7, the allocations to all investment are unconstrained
 - The target of each investment may range from 0% to 100%
- The returns of the unconstrained portfolios are premised on investability and returns each being dependent of the allocation
- The premises are invalid, in Staff's view
 - Portfolios U1 – U7 are intended to be illustrative only

Contribution Portfolio Risk



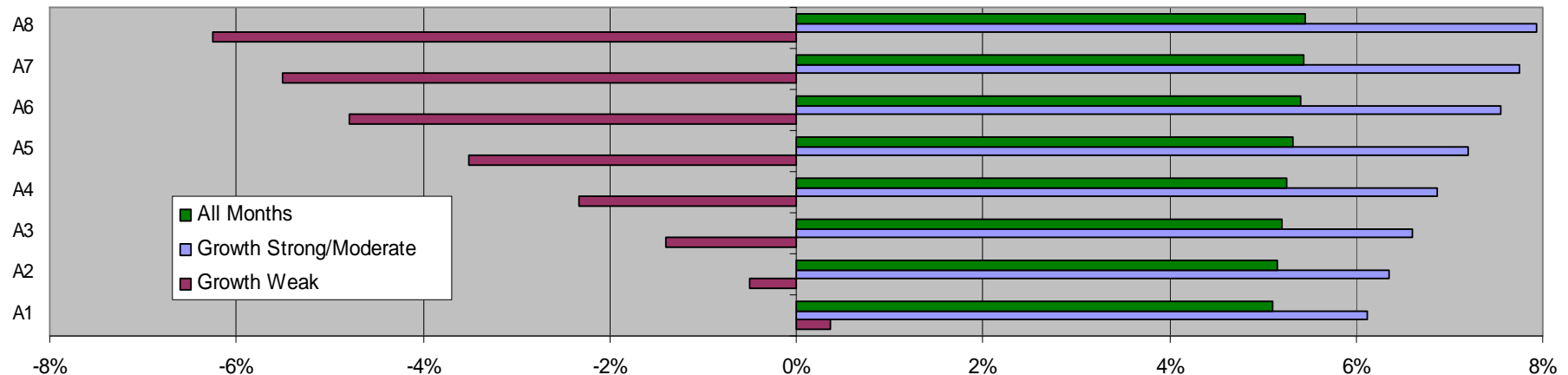
- Contribution to portfolio risk
 - Portion of the variability of portfolio return explained by the returns of an investment
 - Measure of portfolio concentration
- The most conservative portfolio (A1)
 - Is the most diversified
 - Equities represent 32% of the capital and 63% of the risk
 - Equities are assumed to be market cap weighted
- For A7, a proxy of current policy portfolio
 - Equities represent 63% of the capital and 91% of the risk

Capital and Risk Allocation to Economic Growth



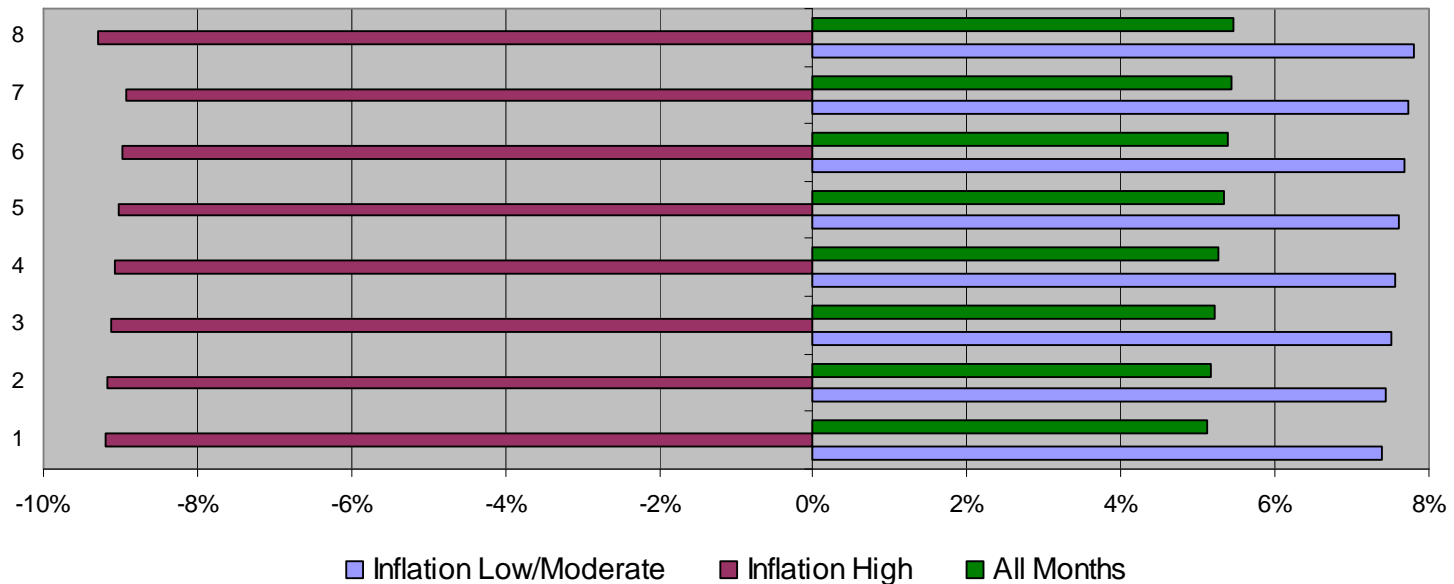
- An economic growth exposure is estimated for each asset class
 - Based on relative returns during periods of strong and weak economic growth
 - Growth exposures of:
 - Equity is 100%; Real is near 100%
 - Liquidity, Fixed Income and Inflation Linked are now at or near zero
- Portfolio growth exposure is the weighted sum of the asset class growth exposures
- Growth Risk allocation is the variation in portfolio returns explained by economic growth
 - Is least for bond-centric portfolio A1 and greatest for equity-dominant A8
- For A7, the portfolio most similar to the current policy portfolio, growth accounts for:
 - 75% of the capital allocation
 - 96% of the risk allocation

Portfolio Simulated Annual Real Return by Economic Growth (Jan 1970 – Jun2010)



- Historical returns were simulated by economic growth environment since 1970 for portfolios A1 – A8
 - Economic growth was strong 17% of the month, moderate 63%, and weak 20%
- Chart shows estimated portfolio returns during periods of:
 - Moderate and strong economic growth (blue)
 - Weak economic growth (maroon)
- Strong and moderate economic growth favors all portfolios
- Outperformance of the riskier portfolios was greatest during strong/moderate growth
 - Riskier assets outperformed overall because growth was strong or moderate 80% of the months

Portfolio Simulated Annual Real Return by Inflation (Jan 1970 – Jun 2010)



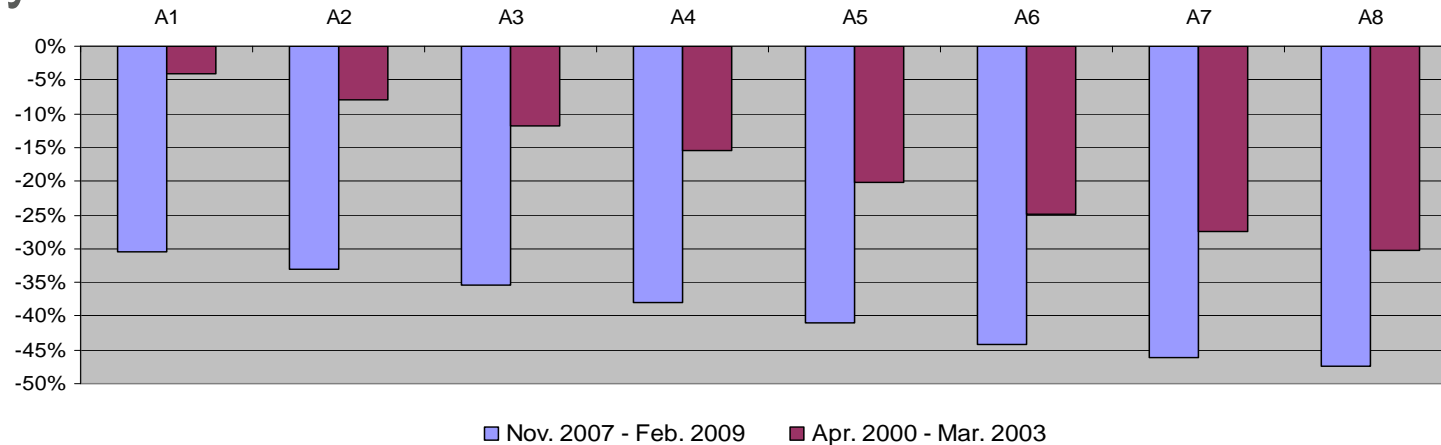
●Portfolio Returns

- Strong during periods of low and moderate inflation
- Poor during high inflation

●Returns were similar across all portfolios

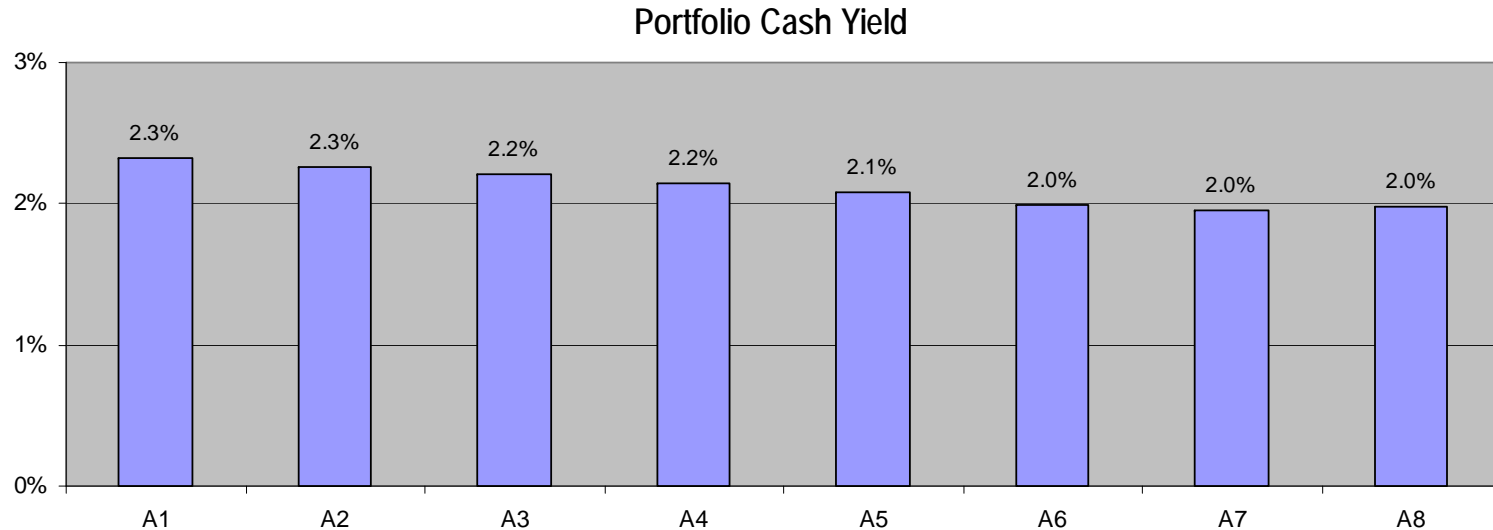
- Equities and nominal bonds both performed poorly during high inflation
- Commodities and inflation linked bonds:
 - Tend to outperform during high inflation, but
 - Represent only 4% of all but one of these portfolios
 - A small allocation given concerns over investability and current pricing

Simulated Portfolio Cumulative Nominal Returns During Recent Equity Market Declines



- Simulated portfolio returns during the two recent equity bear markets are based on:
 - Portfolio asset class weights
 - Asset class benchmark returns during these periods
- Return differenced across portfolios were:
 - Greater during the earlier downturn, when returns of non-equities (real estate, Treasuries, TIPS, fixed income, commodities) were all positive, providing effective diversification
 - Diminished during the latter bear market when real estate and commodities declined with equities
- Portfolio A7 represents losses of the current portfolio
 - Includes estimated market-driven losses in real estate and AIM that were reported in subsequent periods
 - Since 1928, there have been
 - 8 periods of US equity market declines exceeding 45%, once per 13.7 years
 - 15 periods of US equity market declined exceeding 20%, once per 5.5 years

Cash Yield and Liquidity



- Cash yield

- The cash distribution of an investment as a percentage of the initial value
- Is similar across portfolios, because of low bond yields

- Liquidity

- Measured as the policy allocation to bonds, publicly traded equities, cash, and commodities
 - Allocations not to non-publicly traded investments (real estate, private equity, infrastructure, and forestland)
- Is 73% for all portfolios A1 – A8

Appendix

- Portfolios with current asset classification

Return Forecasts: Current Classification

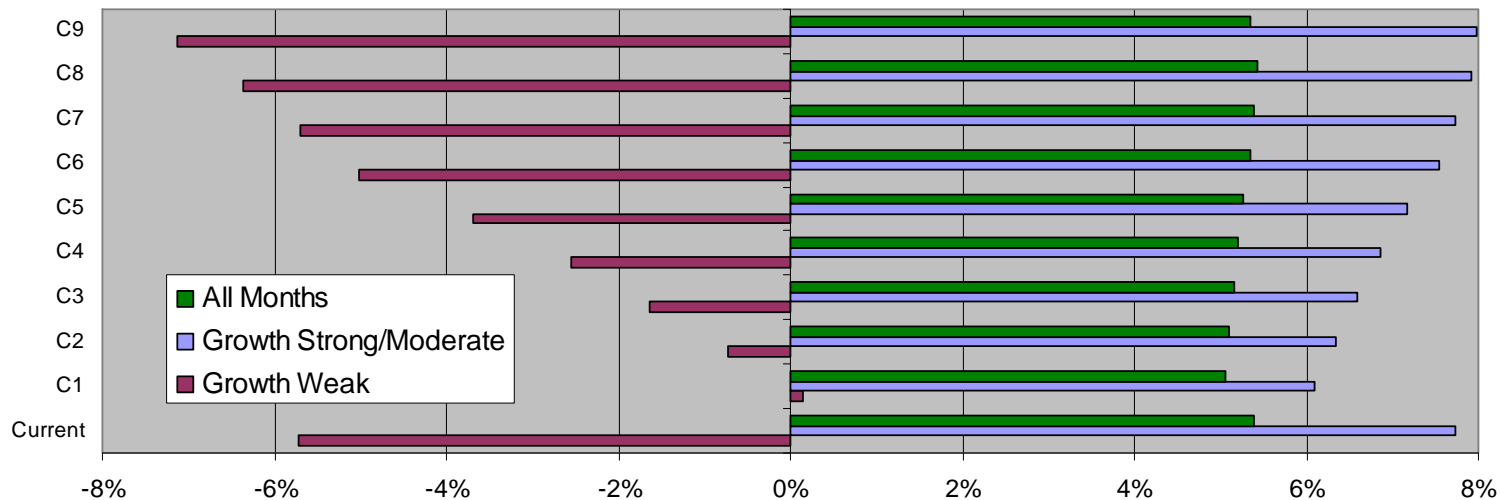
Forecast Expected Values and Volatilities of Returns						
	Compound Return	Volatility	Arithmetic Return	Min	Max	
Fixed Income	3.75%	6.5%	3.95%	15%	100%	
Public Equity	7.75%	16.0%	8.93%	0%	100%	
Private Equity (AIM)	9.00%	26.0%	12.06%	0%	14%	
Real Estate	7.00%	14.0%	7.91%	0%	8%	
Inflation Linked	6.00%	12.5%	6.73%	0%	5%	
Cash	3.25%	1.0%	3.25%	2%	100%	
Forecast Correlations						
	Fixed Income	Public Equity	Private Equity (AIM)	Real Estate	Inflation Linked	Cash
Fixed Income	1.00					
Public Equity	0.10	1.00				
Private Equity (AIM)	0.10	0.80	1.00			
Real Estate	0.15	0.35	0.25	1.00		
Inflation Linked	0.15	0.30	0.30	0.35	1.00	
Cash	0.20	0.00	0.00	0.00	0.00	1.00
Source: all assets except Treasuries and TIPS = June 2010 IC memo 5a						
exception: Forecast Fixed Income compound return was reduced from 4.5% to 3.75% per Sep. 2010 IC memo						

Candidate Portfolios with Current Asset Classification

Forecast Annual Returns	current	C1	C2	C3	C4	C5	C6	C7	C8	C9
Compound return	7.38%	6.00%	6.25%	6.50%	6.75%	7.00%	7.25%	7.38%	7.50%	7.60%
Volatility	11.97%	7.60%	8.23%	8.93%	9.69%	10.53%	11.46%	11.97%	12.45%	13.23%
Average return	8.05%	6.27%	6.57%	6.88%	7.19%	7.52%	7.86%	8.04%	8.22%	8.41%
Fixed Income	20.0%	50.8%	46.2%	41.4%	36.6%	30.6%	23.7%	20.1%	16.6%	15.0%
Public Equity	49.0%	25.9%	28.4%	30.9%	33.5%	38.4%	45.3%	48.9%	52.4%	59.0%
Private Equity	14.0%	6.3%	8.4%	10.7%	12.9%	14.0%	14.0%	14.0%	14.0%	14.0%
Real Estate	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Inflation Linked	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	0.0%
Cash	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%

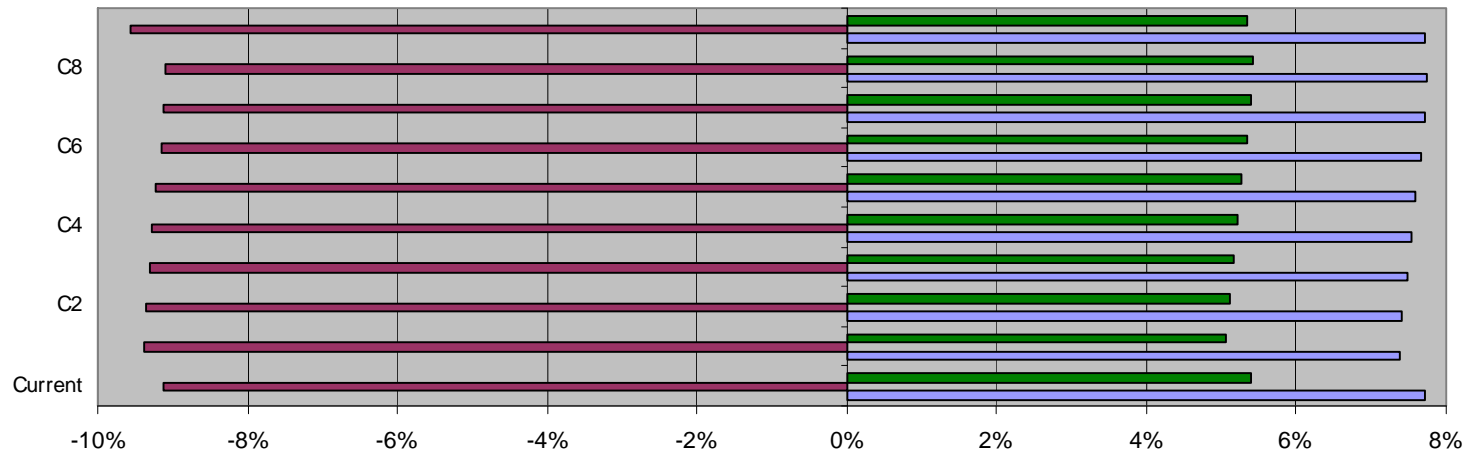
- Portfolios C1 – C7 have same expected compound returns as the alternative portfolios A1 – A7
- The current policy portfolio has an expected annual:
 - Compound return of 7.38%
 - Volatility of 12.0%
 - Given the assumptions listed in the prior slide

Portfolio Simulated Annual Real Return by Economic Growth (Jan 1970 – Jun2010)



- Historical returns were simulated by economic growth environment since 1970 for the current portfolio and C1 – C9
 - Economic growth was strong 17% of the months, moderate 63%, and weak 20%
- Chart shows estimated portfolio returns during periods of:
 - Moderate and strong economic growth (blue)
 - Weak economic growth (maroon)
- Strong and moderate economic growth favors all portfolios
- Outperformance of the riskier portfolios was greatest during strong/moderate growth
 - Riskier assets outperformed overall because growth was strong or moderate 80% of the months

Portfolio Simulated Annual Real Return by Inflation (Jan 1970 –Jun 2010)



•Portfolio Returns

- Strong during periods of low and moderate inflation
- Poor during high inflation

•The results were common across all portfolios

- Equities and nominal bonds both performed poorly during high inflation
- Commodities and inflation linked bonds
 - Tend to outperform during high inflation, but
 - Represent only 2.5% of these portfolios
 - Given current allocation to the Inflation Linked Asset Class

Portfolio Selection by Committee

Farouki Majeed

Richard Roth

Jay Jeong

November 9, 2010

Decision Factors - Reminder

- Decision Factor 1 : Improve Funding Level
 - Funded Ratio is to improve to 90% at the end of 10 years
- Decision Factor 2 : Avoid Deterioration in Funding Level
 - Funded Ratio is to stay above 38% at the end of 10 years
- Decision Factor 3 : Minimize Employer Contribution Rate
 - The average Employer Contribution Rate is to be below 19% at the end of 10 years
- Decision Factor 4 : Stabilize Employer Contribution Rate
 - The average Employer Contribution Rate is to not increase above 40% at the end of 10 years

Decision Factor Weights

Funding Level		Employer Contribution Rate	
DF1 Vote (weight)	5% - 45%	DF3 Vote (weight)	5% - 45%
DF2 Calculated	45% - 5%	DF4 Calculated	45% - 5%
Total (DF1 + DF2)	50%	Total (DF3 + DF4)	50%

Grand Total = 100%

Please select a weight (1-9) for Decision Factor 1

	Decision Factor 1 Assigned Weight	Decision Factor 2 Calculated Weight
1	5%	45%
2	10%	40%
3	15%	35%
4	20%	30%
5	25%	25%
6	30%	20%
7	35%	15%
8	40%	10%
9	45%	5%

Please select a weight (1-9) for Decision Factor 3

	Decision Factor 3 Assigned Weight	Decision Factor 4 Calculated Weight
1	5%	45%
2	10%	40%
3	15%	35%
4	20%	30%
5	25%	25%
6	30%	20%
7	35%	15%
8	40%	10%
9	45%	5%

RECAP

Joe Dear
Chief Investment Officer

November 8, 2010

Recap/Next Steps

Does Asset Allocation Policy Explain 40, 90, or 100 Percent of Performance?

Roger G. Ibbotson and Paul D. Kaplan

Disagreement over the importance of asset allocation policy stems from asking different questions. We used balanced mutual fund and pension fund data to answer the three relevant questions. We found that about 90 percent of the variability in returns of a typical fund across time is explained by policy, about 40 percent of the variation of returns among funds is explained by policy, and on average about 100 percent of the return level is explained by the policy return level.

Does asset allocation policy explain 40 percent, 90 percent, or 100 percent of performance? The answer depends on how the question is asked and what an analyst is trying to explain. According to well-known studies by Brinson and colleagues, more than 90 percent of the variability in a typical plan sponsor's performance over time is the result of asset allocation policy.¹ So, if one is trying to explain the variability of returns *over time*, asset allocation is very important.

Unfortunately, the Brinson et al. studies are often misinterpreted and the results applied to questions that the studies never intended to answer. For example, an analyst might want to know how important asset allocation is in explaining the variation of performance *among funds*. Because the Brinson studies did not address this question, the analyst can neither look to them to find the answer nor fault them for not answering it correctly.² A different study is required.

Finally, an analyst might want to know what percentage of the *level* of a typical fund's return is ascribable to asset allocation policy. Again, the Brinson studies do not address this question. A different study is needed.

Thus, three distinct questions remain about the importance of asset allocation:

1. How much of the variability of returns *across time* is explained by policy (the question Brinson et al. asked)? In other words, how much of a fund's ups and downs do its policy benchmarks explain?
2. How much of the variation in returns *among funds* is explained by differences in policy? In other words, how much of the difference between two funds' performance is a result of their policy difference?
3. What portion of the *return level* is explained by policy return? In other words, what is the ratio of the policy benchmark return to the fund's actual return?

Much of the recent controversy about the importance of asset allocation stems from treating the answer that Brinson et al. provided to Question 1 as an answer to Questions 2 and 3.

The purpose of our study was to ask and answer all three questions. To do this, we examined 10 years of monthly returns to 94 U.S. balanced mutual funds and 5 years of quarterly returns to 58 pension funds. We performed a different analysis for each question.

Framework

Our data consisted of the total return for each fund for each period of time (a month or a quarter). The first step in our analysis was to decompose each total return, TR , into two components, policy return and active return, as follows:

$$TR_{i,t} = (1 + PR_{i,t})(1 + AR_{i,t}) - 1,$$

where

$TR_{i,t}$ = total return of fund i in period t

$PR_{i,t}$ = policy return of fund i in period t

$AR_{i,t}$ = active return of fund i in period t

Roger G. Ibbotson is professor of finance at the Yale School of Management and chair of Ibbotson Associates. Paul D. Kaplan is the director of the Morningstar Center for Quantitative Research. He was vice president and chief economist at Ibbotson Associates when this article was written.

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Policy return is the part of the total return that comes from the asset allocation policy. Active return is the remainder. Active return depends on both the manager's ability to actively over- or underweight asset classes and securities relative to the policy and on the magnitude and timing of those bets.

The asset allocation policy of each fund can be represented as a set of asset-class weights that sum to 1. For the pension funds in this study, these weights were known in advance. For the mutual funds, the policy weights were determined by return-based style analysis, which is described in the "Data" section. The policy return of the fund over a given period of time can be computed from the policy weights and returns on asset-class benchmarks as follows:

$$PR_{i,t} = w_{1i}R_{1t} + w_{2i}R_{2t} + \dots + w_{ki}R_{kt} - c,$$

where

$w_{1i}, w_{2i}, \dots, w_{ki}$ = policy weights of fund i

$R_{1t}, R_{2t}, \dots, R_{kt}$ = returns on the asset classes in period t

c = approximate cost of replicating the policy mix through indexed mutual funds, as a percentage of assets

Thus, in addition to fund returns, we needed policy weights for each fund and total returns on asset-class benchmarks. Given the total returns to the funds and the estimated policy returns of the funds, we solved for the active returns.

In our time-series analysis, we used the period-by-period returns. In our cross-sectional analysis, we used the compound annual rates of return over the period of analysis. For each fund,

we computed the compound annual total return over the entire period as follows:

$$TR_i = \sqrt[N]{(1 + TR_{i,1})(1 + TR_{i,2}) \dots (1 + TR_{i,T})} - 1,$$

where

TR_i = compound annual total return on fund i over the entire period of analysis

$TR_{i,t}$ = total return of fund i in period t

T = number of period returns

N = length of the entire period of analysis, in years

Similarly, we computed the compound annual policy return over the entire period as follows:

$$PR_i = \sqrt[N]{(1 + PR_{i,1})(1 + PR_{i,2}) \dots (1 + PR_{i,T})} - 1,$$

where PR_i is the compound annual policy return on fund i over the entire period of analysis and $PR_{i,t}$ is the policy return to fund i in period t .

Data

For the mutual fund portion of this study, we used 10 years of monthly returns for 94 U.S. balanced funds. The 94 funds represent all of the balanced funds in the Morningstar universe that had at least 10 years of data ending March 31, 1998. Policy weights for each fund were estimated by performing return-based style analysis over the entire 120-month period.³ Table 1 shows the asset-class benchmarks used and the average fund exposure to each asset class.

In calculating the policy returns for each fund, we assumed that the cost of replicating the policy mix through index mutual funds would be 2 basis points a month (approximately 25 bps annually).

Table 1. Asset Classes and Benchmarks for Balanced Mutual Funds

Asset Class	Benchmark	Average Allocation
Large-cap U.S. stocks	CRSP 1-2 portfolio ^a	37.4%
Small-cap U.S. stocks	CRSP 6-8 portfolio ^a	12.2
Non-U.S. stocks	MSCI Europe/Australasia/Far East Index	2.1
U.S. bonds	Lehman Brothers Aggregate Bond Index	35.2
Cash	30-day U.S. T-bills ^b	13.2

^aConstructed by CRSP. CRSP excludes unit investment trusts, closed-end funds, real estate investment trusts, Americus trusts, foreign stocks, and American Depositary Receipts from the portfolios. CRSP uses only NYSE firms to determine the size breakpoints for the portfolios. Specifically, CRSP ranks all eligible NYSE stocks by company size (market value of outstanding equity) and then splits them into 10 equally populated groups, or deciles. The largest companies are in Decile 1, and the smallest are in Decile 10. The capitalization for the largest company in each decile serves as the breakpoint for that decile. Breakpoints are rebalanced on the last day of trading in March, June, September, and December. CRSP then assigns NYSE and Amex/Nasdaq companies to the portfolios according to the decile breakpoints. Monthly portfolio returns are market-cap-weighted averages of the individual returns within each of the 10 portfolios. The 1-2 portfolio is the combination of Deciles 1 and 2, and the 6-8 portfolio is the combination of Deciles 6, 7, and 8.

^bIbbotson Associates (1998).

Stevens, Surz, and Wimer (1999) provided the same type of analysis on quarterly returns of 58 pension funds over the five-year 1993–97 period.⁴ We used the *actual* policy weights and asset-class benchmarks of the pension funds, however, rather than estimated policy weights and the same asset-class benchmarks for all funds. In each quarter, the policy weights were known in advance of the realized returns.⁵ We report the pension fund results together with our analysis of the mutual fund returns in the next section.

Questions and Answers

Now consider the original three questions posed by the study: How much of the variability of return across time is explained by asset allocation policy, how much of the variation among funds is explained by the policy, and what portion of the return level is explained by policy return?

Question #1: Variability across Time. The Brinson et al. studies from 1986 and 1991 answered the question of how much of the variability of fund returns is explained by the variability of policy returns. They calculated the result by regressing each fund's total returns ($TR_{i,t}$ in our notation) against its policy returns ($PR_{i,t}$), reporting the R^2 value for each fund in the study, then examining

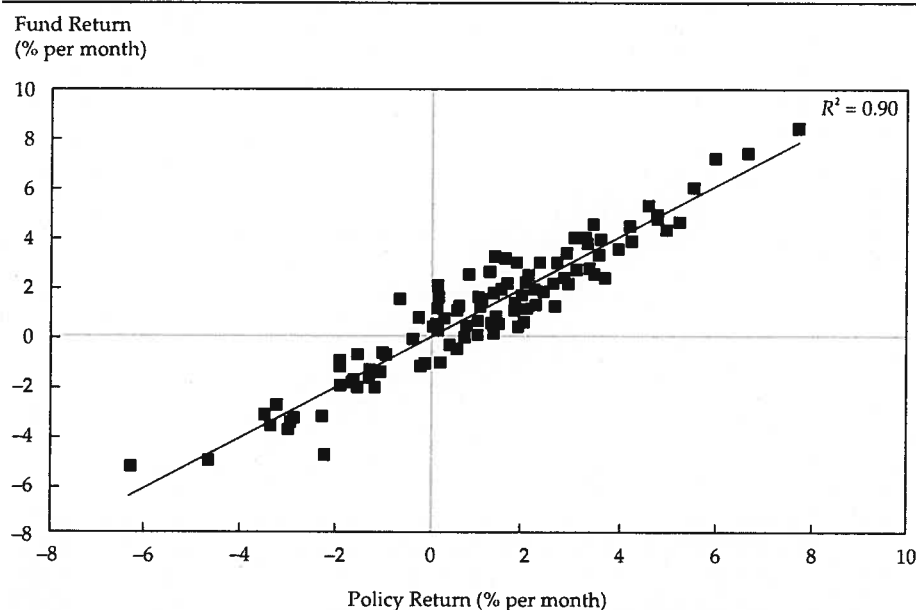
the average, median, and distribution of these results.

Figure 1 illustrates the meaning of the time-series R^2 with the use of a single fund from our sample. In this example, we regressed the 120 monthly returns of a particular mutual fund against the corresponding monthly returns of the fund's estimated policy benchmark. Because most of the points cluster around the fitted regression line, the R^2 is quite high. About 90 percent of the variability of the monthly returns of this fund can be explained by the variability of the fund's policy benchmark.

In the first Brinson et al. study (1986), the authors studied quarterly returns over the 1974–83 period for 91 large U.S. pension funds. The average R^2 was 93.6 percent. In the second Brinson et al. study (1991), they studied quarterly returns over the 1978–87 period for 82 large U.S. pension funds. The average R^2 was 91.5 percent. Based on these results, the authors stated that more than 90 percent of the variability of the average fund's return across time is explained by that fund's policy mix.

The Brinson et al. results show that strategic asset allocation explains much of the variability of pension fund returns because plan sponsors select a long-term strategic target and tend to stick to it.

Figure 1. Time-Series Regression of Monthly Fund Return versus Fund Policy Return: One Mutual Fund, April 1988–March 1998



Note: The sample fund's policy allocations among the general asset classes were 52.4 percent U.S. large-cap stocks, 9.8 percent U.S. small-cap stocks, 3.2 percent non-U.S. stocks, 20.9 percent U.S. bonds, and 13.7 percent cash.

If plan sponsors were more active, the R^2 s would be lower.

The results from our analysis of both the mutual fund and the pension data are presented in Table 2, together with the Brinson et al. results. Our results confirm the Brinson result that approximately 90 percent of the variability of a fund's return across time is explained by the variability of policy returns. The result in our study for the median mutual fund was 87.6 percent, and the result for the median pension fund was 90.7 percent. The mean results in our study were slightly lower (81.4 percent and 88.0 percent, respectively) because they were skewed by the effect of a few outlier funds. These results are consistent with the notion that pension fund managers as a group are less active than balanced mutual fund managers.

Table 2. Comparison of Time-Series Regression Studies

Measure	Brinson 1986	Brinson 1991	Mutual Funds	Pension Funds
R^2				
Mean	93.6%	91.5%	81.4%	88.0%
Median	NA	NA	87.6	90.7
Active return ^a				
Mean	-1.10	-0.08	-0.27	-0.44
Median	NA	NA	0.00	0.18

NA = not available.

^aActive return is expressed as a percentage per year.

Table 3 displays the range of outcomes in our study and shows that the mutual funds were more active than the pension funds. The mutual fund at the 5th percentile of R^2 had only 46.9 percent of the variability of returns explained by the variability of returns of the policy, whereas for the fund at the 95th percentile, the R^2 was 94.1 percent. For the pension funds, the R^2 s are in the tighter range of 66.2 percent at the 5th percentile and 97.2 percent at the 95th percentile.

We next considered that the time-series R^2 may be high simply because funds participate in the capital markets in general and not because they

follow a specific asset allocation policy. We explored this idea by regressing each mutual fund's total returns against the total returns to a common benchmark (rather than each against the returns to its own policy benchmark). For common benchmarks, we used the S&P 500 Index and the average of all of the policy benchmarks shown in Table 1.

The results are shown in Table 4. With the S&P 500 as the benchmark for all funds, the average R^2 was more than 75 percent and the median was nearly 82 percent. With the average policy benchmarks across funds as the benchmark, the average R^2 was nearly 79 percent and the median was more than 85 percent. These results are relatively close to those obtained when we used each specific fund's benchmark. Hence, the high R^2 in the time-series regressions result primarily from the funds' participation in the capital markets in general, not from the specific asset allocation policies of each fund. In other words, the results of the Brinson et al. studies and our results presented in Table 2 are a case of a rising tide lifting all boats.

Table 4. Explaining a Mutual Fund's Time Series of Returns Using Different Benchmarks

R^2	S&P 500	Average Policy	Fund's Policy
Mean	75.2%	78.8%	81.4%
Median	81.9	85.2	87.6

Hensel, Ezra, and Ilkiw (1991) made a similar point in their study of the importance of asset allocation policy. In their framework, a naive portfolio had to be chosen as a baseline in order to evaluate the importance of asset allocation policy. They pointed out that in the Brinson et al. studies, the baseline portfolio was 100 percent in cash. In other words, the Brinson studies were written as if the alternative to selecting an asset allocation policy were to avoid risky assets altogether. When we used a more realistic baseline, such as the average policy benchmark across all funds, we found that the specific policies explain far less than half of the remaining time-series variation of the funds' returns.

Question #2: Variation among Funds. To answer the question of how much of the variation in returns among funds is explained by policy differences, one must compare funds with each other through the use of cross-sectional analysis. Many people mistakenly thought the Brinson studies answered this question. If all funds were invested passively under the same asset allocation policy, there would be no variation among funds (yet 100

Table 3. Range of Time-Series Regression R^2 Values

Percentile	Mutual Funds	Pension Funds
5	46.9%	66.2%
25	79.8	94.1
50	87.6	90.7
75	91.4	94.7
95	94.1	97.2

percent of the variability of returns across time of each fund would be attributable to asset allocation policy). If all funds were invested passively but had a wide range of asset allocation policies, however, all of the variation of returns would be attributable to policy.

To answer the question of how much of the variation in returns among funds is explained by policy differences, we compared each fund return with each other fund's return. We carried out a cross-sectional regression of compound annual total returns, TR_{it} , for the entire period on compound annual policy returns, PR_{it} , for the entire period. The R^2 statistic of this regression showed that for the mutual funds studied, 40 percent of the return difference was explained by policy and for the pension fund sample, the result was 35 percent.

Figure 2 is the plot of the 10-year compound annual total returns against the 10-year compound annual policy returns for the mutual fund sample. This plot demonstrates visually the relationship between policy and total returns. The mutual fund result shows that, because policy explains only 40

percent of the variation of returns across funds, the remaining 60 percent is explained by other factors, such as asset-class timing, style within asset classes, security selection, and fees. For pension funds, the variation of returns among funds that was not explained by policy was ascribable to the same factors and to manager selection.

The cross-sectional R^2 depended on how much the asset allocation policies of funds differed from one another and on how much the funds engaged in active management. To see how much asset allocation policies differed, we examined the cross-sectional distributions of the style weights. Table 5 presents the cross-sectional averages, standard deviations, and various percentiles of the style weights of the mutual funds. The last column presents these statistics for the total style allocation to equity. The large standard deviations and spreads between the percentiles indicate large variations in asset allocation policies among the funds.

Given how diverse the asset allocation policies are among these mutual funds, the relatively low R^2 of 40 percent must be the result of a large degree

Figure 2. Fund versus Policy: 10-Year Compound Annual Return across Funds, April 1988–March 1998

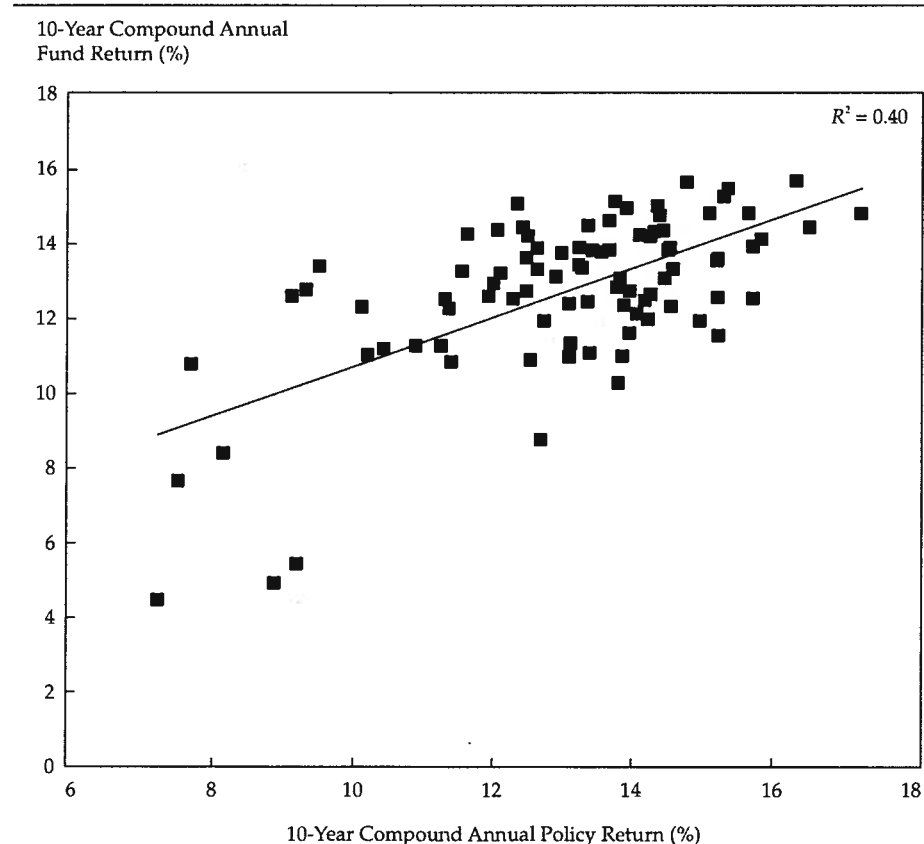


Table 5. Cross-Sectional Distributions of Balanced Mutual Fund Policy Weights

Measure	Large-Cap U.S. Stocks	Small-Cap U.S. Stocks	Non-U.S. Stocks	U.S. Bonds	Cash	Total Equities
Average	37.4%	12.2%	2.1%	35.2%	13.2%	51.6%
Standard deviation	17.0	7.6	2.3	14.4	15.9	16.0
Percentile						
5	1.2	1.1	0.0	12.8	0.0	23.3
25	29.9	7.1	0.0	26.6	1.0	44.5
50	40.2	11.0	1.5	35.2	7.7	54.5
75	48.8	16.5	3.1	45.1	17.5	62.0
95	56.2	24.8	6.4	56.7	47.3	74.1

of active management. To see how the degree of active management can affect the cross-sectional R^2 , we calculated the cross-sectional R^2 between the 10-year annual returns of the policy benchmarks and the 10-year annual returns of a set of modified fund returns. Each modified fund return was a weighted average of the actual fund return with the return on the policy benchmark so that the degree of active management was adjusted as follows:

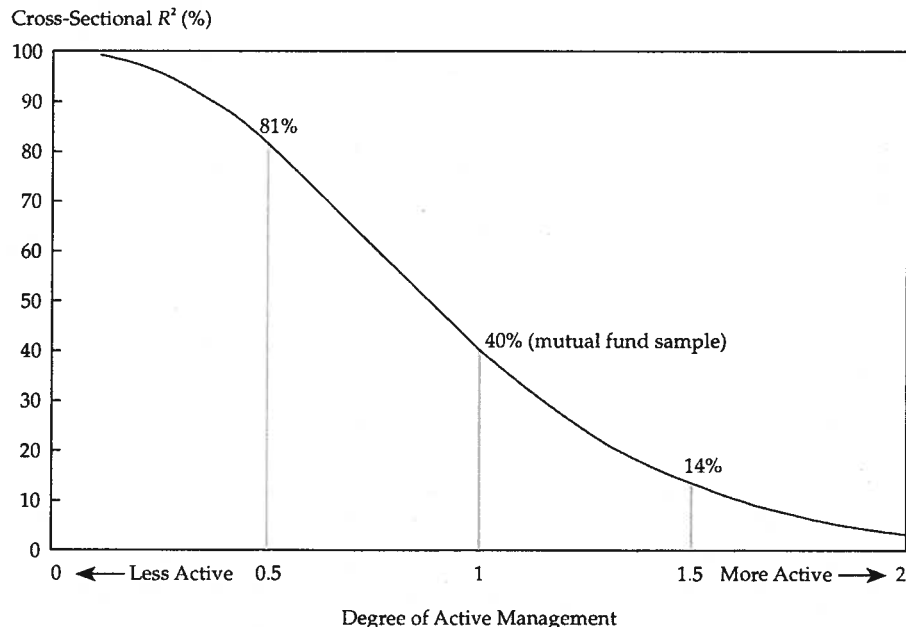
$$TR_{i,t}^* = xTR_{i,t} + (1-x)PR_{i,t},$$

where the value of x sets the level of active management. Setting x equal to 1 gives the sample result. Setting x less than 1 reduces the level of active management below what the funds actually did. Setting x greater than 1 shorts the benchmark and takes a levered position in the fund, thus increasing

the level of active management beyond what the funds actually did.

The compound annual return of modified fund returns, $TR_{i,t}^*$, was calculated the same way as the compound annual return of actual fund returns (i.e., as the geometric mean of the modified annual returns).

Figure 3 shows the cross-sectional R^2 from regressing the modified compound annual returns on compound annual policy returns for various values of x . At $x = 1$, the cross-sectional R^2 is our original result, 40 percent. If the funds had been half as active ($x = 0.5$), the R^2 would have been much higher, 81 percent. On the other hand, if the funds had been one-and-a-half times as active ($x = 1.5$), the R^2 would have been only 14 percent. Thus, this approach shows how the degree of active management affects the cross-sectional R^2 .

Figure 3. Degree of Active Management versus Cross-Sectional R^2 , April 1988–March 1998

Question #3: Return Level. Many people also mistakenly thought the Brinson et al. studies were answering what portion of the return level is explained by asset allocation policy return, with an answer indicating nearly 90 percent. Brinson and his co-authors were not, however, addressing this question. We can address the question by using the Brinson data and the new data from our pension fund and mutual fund studies. We calculated the percentage of fund return explained by policy return for each fund as the ratio of compound annual policy return, PR_t , divided by the compound annual total return, TR_t . This ratio of compound returns is really simply a performance measure. A fund that stayed exactly at its policy mix and invested passively will have a ratio of 1.0, or 100 percent, whereas a fund that outperformed its policy will have a ratio less than 1.0.

Table 6 shows the percentage of fund return explained by policy return for the Brinson studies and the two data sets used in this study. On average, policy accounted for a little more than all of total return. The one exception is the pension fund sample in this study, where the mean result was 99 percent. The pension data did not have any expenses subtracted, however, so if we included external manager fees, pension staff costs, and other expenses, the result would probably be close to 100 percent, meaning that no value was added above the benchmark. On average, the pension funds and balanced mutual funds are not adding value above their policy benchmarks because of a combination of timing, security selection, management fees, and expenses. Moreover, results for both groups here may even be better than expected because the timing component might include some benefit from not rebalancing (letting equities run), which would have helped returns in the sample period's nearly continuous U.S. equity bull market.

The range of percentage of fund return explained by policy return is shown in Table 7. The mutual funds have a wider range because they are more willing to make timing and selection bets against the benchmark.

These results were anticipated by Sharpe (1991). He pointed out that because the aggregation of all investors is the market, the average perfor-

Table 6. Percentage of Total Return Level Explained by Policy Return

Study	Average	Median
Brinson 1986	112%	NA
Brinson 1991	101	NA
Mutual funds	104	100%
Pension funds	99	99

NA = not available.

Table 7. Range of Percentage of Total Return Level Explained by Policy Return

Percentile	Mutual Funds	Pension Funds
5 (best)	82%	86%
25	94	96
50	100	99
75	112	102
95 (worst)	132	113

mance before costs of all investors must equal the performance of the market. Because costs do not net out across investors, the average investor must be underperforming the market on a cost-adjusted basis. The implication is that, on average, more than 100 percent of the level of fund return would be expected from policy return. Of course, this outcome is not assured for subsamples of the market, such as balanced mutual funds or pension funds.

In our analysis, a fund's policy return measures the performance of the asset classes in which that fund invests. Therefore, based on Sharpe's thesis, we would predict that, on average, a little more than 100 percent of the level of total return would be the result of policy return.⁶ Our results confirm this prediction.

This is not to say that active management is useless. An investor who has the ability to select superior managers before committing funds can earn above-average returns. If, as Goetzmann and Ibbotson (1994) suggested, superior performance and inferior performance persist over time, one need only invest in the funds that have outperformed in the past. Nevertheless, the average return across all funds in the market cannot be greater than the return on the market.

Conclusion

We sought to answer the question: What part of fund performance is explained by asset allocation policy? If we think of this issue as a multiple-choice question with "40 percent," "90 percent," "100 percent," and "all of the above" as the choices, our analysis shows that asset allocation explains about 90 percent of the variability of a fund's returns *over time* but it explains only about 40 percent of the variation of returns *among funds*. Furthermore, on average across funds, asset allocation policy explains a little more than 100 percent of the *level* of returns. So, because the question can be interpreted in any or all of these ways, the answer is "all of the above."

This article grew out of discussions with Ron Surz. We thank Dale Stevens for providing the pension fund data and Mark Wimer of Ibbotson Associates for his able assistance.

Notes

1. Brinson, Hood, and Beebower (1986); Brinson, Singer, and Beebower (1991).
2. The essence of Jahnke's (1997) critique of the Brinson et al. studies is that they used time-series R^2 s to address the question of cross-sectional variability. This critique is unfair because the Brinson studies never addressed the cross-sectional question.
3. Return-based style analysis was first proposed by Sharpe (1992). See Lucas (1998) for a detailed discussion.
4. The results are reported in Stevens, Surz, and Wimer, together with the mutual fund results reported here.
5. The average allocations among the general asset classes used in the pension fund study were 43.7 percent U.S. stocks, 38.0 percent U.S. bonds, 5.0 percent cash, and 13.3 percent other asset classes.
6. We have taken out the cost of indexing from the policy return, so the average underperformance of the fund is less than what Sharpe's analysis would suggest.

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Pension Dispute Ensnarers a Board

By MICHAEL CORKERY

One is mayor of Highland Park, Ill. Another is assistant municipal manager of Mount Lebanon, Pa., a Pittsburgh suburb. Another runs Tennessee's state-government accounting system.

The three also are members of the seven-person Governmental Accounting Standards Board, or GASB, a nonprofit organization that sets accounting rules for thousands of state and local governments. And their board is at the center of a debate over how governments should account for money owed to retired workers.

The three individuals, plus a fourth who is the Orange County, Calif., auditor-controller, all are experienced in accounting or finance. But critics say they have conflicts of interest because they work for local, state or county governments, giving them a vested interest in accounting standards that would help public pension funds minimize future contributions.

At the heart of the debate is the issue about how funds calculate the size of their future obligations to retirees. By reducing this discount rate, GASB could force some governments to put more money into pension plans.

Critics say the current rates used by many funds are too high, because they largely are based on unrealistic return expectations for the funds' investments.

The board has proposed a blended rate, depending on the expected level of assets in a pension fund.

Critics contend the proposed accounting change isn't tough enough on pension systems that haven't owned up to the true size of their liabilities to retired workers.

"This is passing a lot of cost or risk onto future generations," says Jeremy Gold, an independent actuary in New York who advises GASB and favors reducing the discount rate. Many large pension plans use an 8% discount rate.

The board's release in June of the proposed change, among others, has put GASB in the cross hairs.

"Look at the incentives for the people on the board," says Keith Ambachtsheer, director of the University of Toronto's Rotman International Centre for Pension Management. "They are likely to listen to their constituents in state and local governments and the labor unions who say there is no problem using the current discount rate."

GASB board members declined to comment through a spokesman for the accounting-standards organization. The spokesman, Neal McGarity, said in a statement that board members "do not represent particular constituencies," adding that their deliberations about the discount rate run "counter to any alleged bias."

Charles Holland, finance director of Cocoa Beach, Fla., says GASB benefits from having board members with government experience who understand the pressures facing cities.

"I want board members who have boots on the ground, and not just academic credentials," Mr. Holland says.

With a staff of about 30 employees, many with accounting and finance experience, GASB has been overshadowed by its corporate-accounting cousin, the Financial Accounting Standards Board. The two organizations share an office in Norwalk, Conn., but they are worlds apart in many ways.

Being a FASB board member is considered a full-time job, earning compensation of about \$600,000 in 2008, according to tax documents.

GASB won't disclose what its board members are paid, but people familiar with the matter say they get less than half the amount earned by FASB board members and work about one-third as much. GASB board members are considered part-time officials. The only exception is GASB's full-time chairman, who earned \$359,000 in 2008.

FASB rules are enforced by the Securities and Exchange Commission, which also oversees the group.

GASB rules are voluntary, though governments that don't follow its standards risk unnerving municipal-bond investors, possibly leading to higher borrowing costs.

GASB has no government oversight, and its funding comes from selling trade publications and contributions from state and local governments and the municipal-bond industry, according to the group's website. The Dodd-Frank law passed in July authorizes the SEC to explore a full-time funding source for GASB from fees charged to the securities industry.

Another difference: For corporate pension funds, FASB uses a discount rate based on the interest rates of a portfolio of highly rated corporate bonds. That rate of roughly 6% is lower than the discount rate used by many public pension funds. Using a lower discount rate would mean larger obligations for many public pension funds, likely triggering increases in required contributions from employers and employees.

GASB's proposed revision essentially would blend two discount rates.

Pension systems that expect to have enough assets to cover their retiree obligations for many years to come could use their current expected rate of return. But for pension plans that expect to deplete their assets, the proposal calls for certain retiree obligations to be discounted based on a municipal-bond rate, currently averaging 2% to 3%.

The accounting group has received at least 180 comments about the proposed changes. Outside of GASB, actuaries, usually considered wonky number crunchers, are nearly "coming to blows" over the issue, says one person who is familiar with the process.

GASB will seek additional comments in hearings next month. A final vote by the board isn't expected for at least a year.

Mr. Gold, the independent actuary, says the proposal would allow "the great majority of plans" to "continue using their expected rate of return."

Mr. Holland, the Cocoa Beach finance director, says any discount-rate reductions should occur in small increments. "The academics are trying to kill a fly with a shotgun," he says. "You will be forcing a hardship on people and not accomplishing anything."

RETIREMENT PLANNING SEPTEMBER 18, 2010

Pension Gaps Loom Larger

Funds Stick to 'Unrealistic' Return Assumptions, Threatening Bigger Shortfalls

By DAVID REILLY

Many of America's largest pension funds are sticking to expectations of fat returns on their investments even after a decade of paltry gains, which could leave U.S. retirement plans facing an even deeper funding hole and taxpayers on the hook for huge additional contributions.

The median expected investment return for more than 100 U.S. public pension plans surveyed by the National Association of State Retirement Administrators remains 8%, the same level as in 2001, the association says.

The country's 15 biggest public pension systems have an average expected return of 7.8%, and only a handful recently have changed or are reconsidering those return assumptions, according to a survey of those funds by The Wall Street Journal.

Corporate pension plans in many cases have been cutting expectations more quickly than public plans, but often they were starting from more-optimistic assumptions. Pension plans at companies in the Standard & Poor's 500 stock index have trimmed expected returns by one-half of a percentage point over the past five years, but their average return assumption is also 8%, according to the Analyst's Accounting Observer, a research firm.

The rosy expectations persist despite the fact that the Dow Jones Industrial Average is back near the 10000 level it first breached in 1999. The 10-year Treasury note is yielding less than 3%, and inflation is running at only about 1%, making it tougher for plans to hit their return targets.

Return assumptions can affect the size of so-called funding gaps—the amounts by which future liabilities to retirees exceed current pension assets. That's because government plans use the return rates to calculate how much money they need to meet their future obligations to retirees. When there are funding gaps, plans have to get more contributions from either employers or employees.

The concern is that the reluctance to plan for smaller gains will understate the scale of the potential time bomb facing America's government and corporate pension plans.

"It's unrealistic," [John Bogle](#), founder of mutual fund giant Vanguard, says of the return assumptions in place at most pension plans.

Pension funds at companies in the S&P 500 faced a \$260 billion shortfall at the end of 2009, according to Standard & Poor's. Estimates of the fund deficits faced by state and local governments range from \$500 billion to \$1 trillion.

Some plans are beginning to trim their return forecasts.

Earlier this month, New York State Comptroller Thomas DiNapoli said he would reduce the expected rate of investment return for his state's pension system, the third-largest in the nation, to 7.5%, from 8%.

Forecasting Challenge

Median annualized investment returns for public pension plans, by time span



The country's two biggest plans—the California Public Employees Retirement System, or Calpers, and the California State Teachers' Retirement System, or CalSTRS—both are undergoing reviews of projected investment returns that could lead to reductions later this year.

Many plans have held onto an 8% return expectation though thick and thin. Such return assumptions partly reflect the heady years of the 1990s bull market. Public pension plans posted a median, annualized return of 9.3% over the past 25 years, but just 3.9% over the past 10, according to consulting firm Callan Associates.

The Oregon Public Employees Retirement System has had an 8% assumption since 1989. Its actual return averaged 10.7% annually from 1970 through 2009. The Teachers Retirement System of Texas has had a similar expectation since 1986, with an annual return of 9% return since then.

A spokeswoman for the Texas system said it doesn't change assumptions "in response to short-term situations," and currently "sees no reason to change our investment-return assumption." A spokesman for the Oregon system said there are no special plans to review its return expectation.

The challenge for many plans, given investment horizons that can stretch out 50 years, is gauging which time period to look at when charting a future course.

George Diehr, vice president of the Calpers board, said in May that the question is whether the credit crisis has "dramatically altered long-held assumptions about investing in the world's financial markets. Are investors in for a sustained period of meager or below-market growth? Or will the traditional business and economic cycles, the ones investors have grown accustomed to over the past couple of decades, return?"

The outcome of Calpers's ongoing review "hangs on how we answer that question," a spokesman says.

Depressed stock prices aren't the only thing putting pressure on potential returns. Plummeting bond yields mean that plans' fixed-income portfolios will likely earn less in the future. A lower inflation outlook means that funds will have to generate greater real returns to meet their return targets.

Funds use a so-called discount rate to estimate the size of future obligations to retirees, and thus the contributions needed to fund them. Corporate plans use a discount rate based on corporate bond yields. But government plans use their expected return rate on all investments as their discount rate.

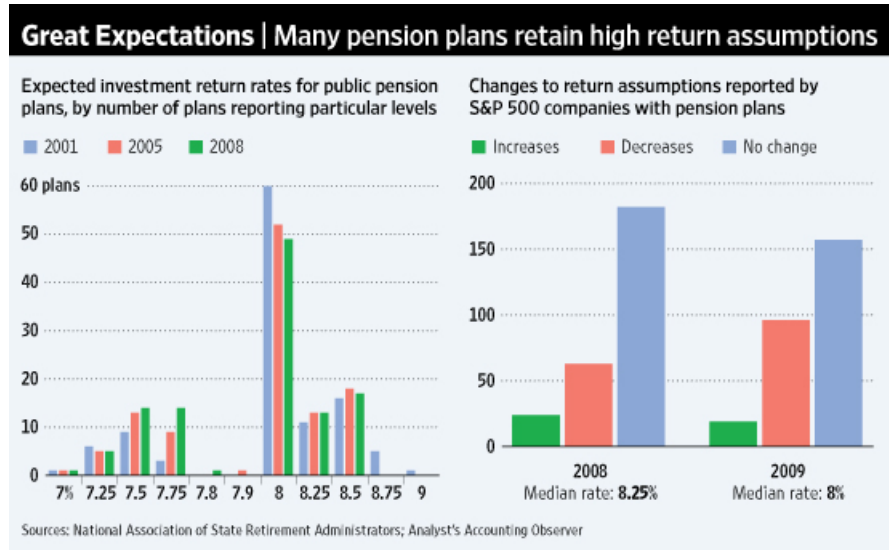
The higher the discount rate, the smaller a fund's pension obligation. That gives public plans another big reason to hesitate before cutting their expected return rates.

The Colorado Public Employees Retirement Association showed in its 2009 financial report the impact of reducing the rate. Using a 8% expected return rate, the plan faced a \$23.4 billion deficit, based on market values, at the end of 2009. If the rate was cut to 6.5%, the shortfall would jump to \$34 billion.

Meredith Williams, the Colorado plan's chief executive, says cutting the rate "creates pain." Nevertheless, Colorado at year-end of 2009 cut its return assumption to 8%, from 8.5%. Mr. Williams says the rate may be lowered again later this year.

Others have been more hesitant. In 2009, Matt Smith, state actuary for Washington state, recommended that its retirement system cut its return expectation to 7.5%, from 8%. That advice was rejected by the state's pension-funding council.

Mr. Smith says he thinks Washington and other states eventually will lower expected returns, but that it will be a slow process because reduced assumptions "will increase the cost of pension benefits, and right now the budgetary environment is a big obstacle to that."



Pension plans say they take a decades-long view of potential returns. "We can't knee-jerk our way through this. Funding a retirement system is a long-term proposition," says David Stella, secretary of Wisconsin's department of employee trust funds. Last year Wisconsin's plan

reviewed its expected return rate of 7.8% and remains comfortable with it, he says.

Companies have found out the hard way that their options are limited. From 2005 to 2009, S&P 500 companies with pension plans expected to generate about \$475 billion in returns. The actual returns were only about \$239 billion, a 50% undershoot, according to Jack Ciesielski of the Analyst's Accounting Observer.

In recent years, some funds have tried to boost returns by shifting funds out of stock and into alternative investments such as hedge funds or private equity.

Some find this approach too risky. This summer, the Virginia Retirement System cut its expected investment rate to 7%, from 7.5%, giving it the lowest assumption among the nation's 15 largest pension systems. The shift began in 2005, when the plan's board cut the rate to 7.5%, from 8%.

"There was a general thinking that equity markets were unlikely to repeat the period of the 1990s," explains director Robert Schultze.

The alternative was to take more risk, he says, but the board didn't want to "stretch or be swinging for the fences" to meet higher investment expectations.

Other plans, he predicts, will follow suit. "I just think people are going to be coming off that 8% view," he says.



Wilshire 2010 Asset Allocation Assumptions

Introduction: The Asset Allocation Process

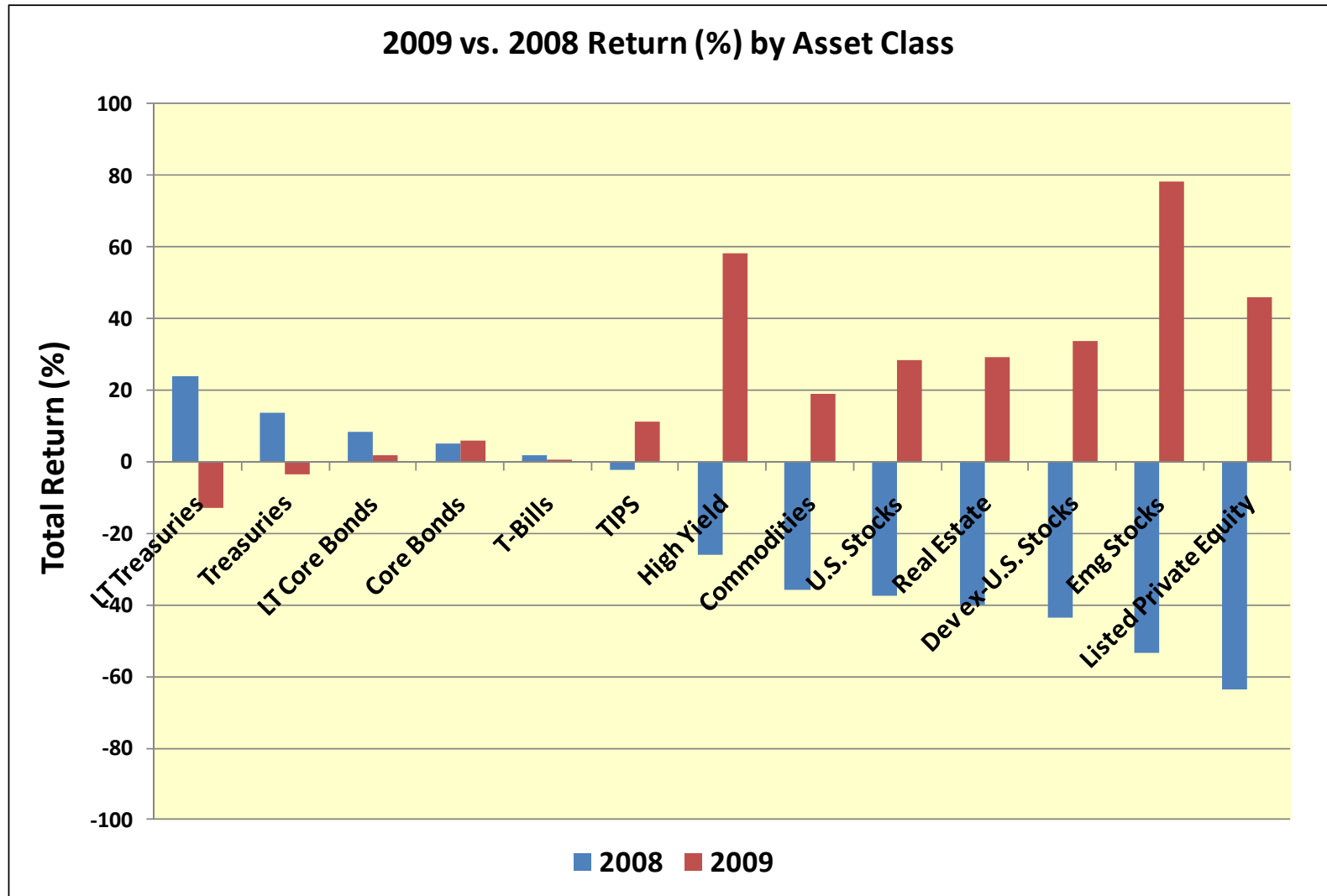
- **First step in asset allocation process**
- **Long-term estimates**
- **Reviewed at least annually**
- **Combine historical data with forward-looking analysis**

Introduction: Challenging Markets

- **Volatile environment**
 - 2007-2008 credit crisis & flight to quality
 - 2009 market recovery
- **Difficult conditions for long-term forecasting**
 - Traditional models with a proven record must be scrutinized in the current environment
 - Overlay judgment to enhance quantitative signals while maintaining transparency in the forecasting process

Introduction: Challenging Markets

- What a difference a year makes!



Source: Wilshire Compass

* 2009 Listed Private Equity Return is through Sept 2009

Introduction: Assumptions at a Glance

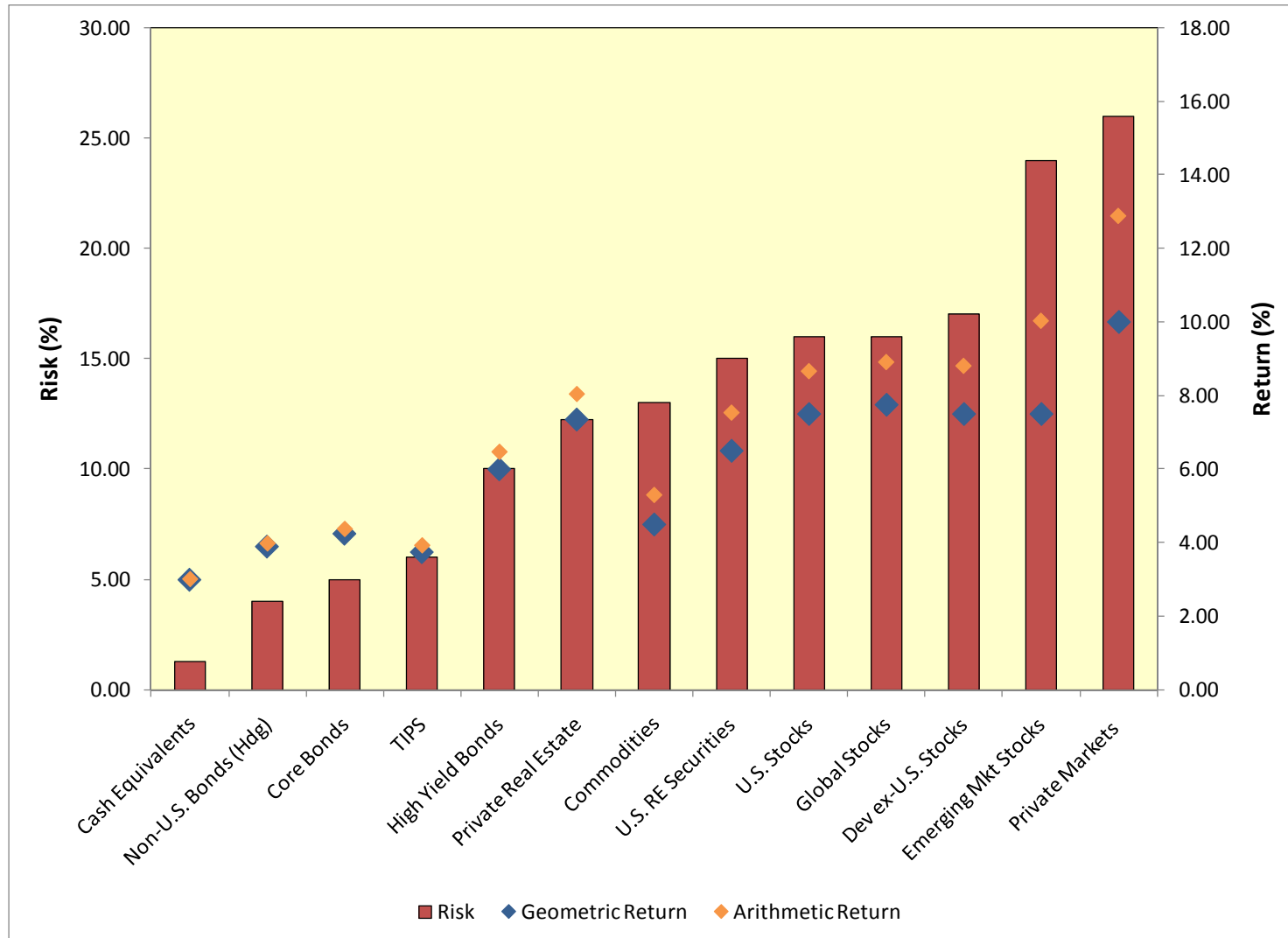
- Wilshire's 2010 Return and Risk Assumptions**

	<u>Total Return</u>			<u>Risk</u>		
	MY 2009	2010	Change	MY 2009	2010	Change
<u>Investment Categories:</u>						
U.S. Stocks	8.00 %	7.50 %	-0.50 %	16.00 %	16.00 %	0.00 %
Dev ex-U.S. Stocks	8.00	7.50	-0.50	17.00	17.00	0.00
Emerging Mkt Stocks	8.00	7.50	-0.50	24.00	24.00	0.00
Global Stocks	8.20	7.75	-0.45	16.00	16.00	0.00
Private Markets	11.15	10.00	-1.15	26.00	26.00	0.00
Cash Equivalents	2.25	3.00	0.75	1.25	1.25	0.00
Core Bonds	4.25	4.25	0.00	5.00	5.00	0.00
TIPS	3.50	3.75	0.25	6.00	6.00	0.00
High Yield Bonds	6.75	6.00	-0.75	10.00	10.00	0.00
Non-U.S. Bonds (Hdg)	3.90	3.90	0.00	4.00	4.00	0.00
U.S. RE Securities	7.25	6.50	-0.75	15.00	15.00	0.00
Private Real Estate	7.90	7.35	-0.55	12.25	12.25	0.00
Commodities	3.75	4.50	0.75	13.00	13.00	0.00
Real Asset Basket *	6.65	6.75	0.10	7.50	7.50	0.00
Inflation:	1.75	2.50	0.75	1.75	1.75	0.00

* The 2009 MY return/risk uses 2009 MY forecasts with 2010 real asset sub - asset class component weights

Introduction: Assumptions at a Glance

- Wilshire's 2010 return & risk forecasts (from low to high risk)



Introduction: Assumptions at a Glance

- Wilshire's 2010 forecasts vs. historical returns**

	Historical Returns (%)					Wilshire Forecast (%)
	1802-2009 *	1926-2009	High Inflation 1970-1979	Bull Market 1980-1999	"Lost Decade" 2000-2009	
Total Returns:						
Stocks	8.0	9.8	5.9	17.8	-1.0	7.5
Bonds	4.9	5.7	7.2	10.0	6.3	4.3
T-bills	4.2	3.8	6.4	7.2	3.0	3.0
Inflation:	1.4	3.0	7.4	4.0	2.5	2.5
Returns minus Inflation:						
Stocks	6.6	6.8	-1.5	13.8	-3.5	5.0
Bonds	3.5	2.7	-0.2	6.0	3.8	1.8
T-bills	2.8	0.7	-1.0	3.1	0.5	0.5
Stocks minus Bonds:	3.1	4.1	-1.3	7.8	-7.3	3.3

* Jeremy Siegel returns from 1802-2001 ("Stocks for the Long Run" McGraw-Hill 2002) updated with S&P 500 Index and Barclays Capital Aggregate Index.

- A few observations**

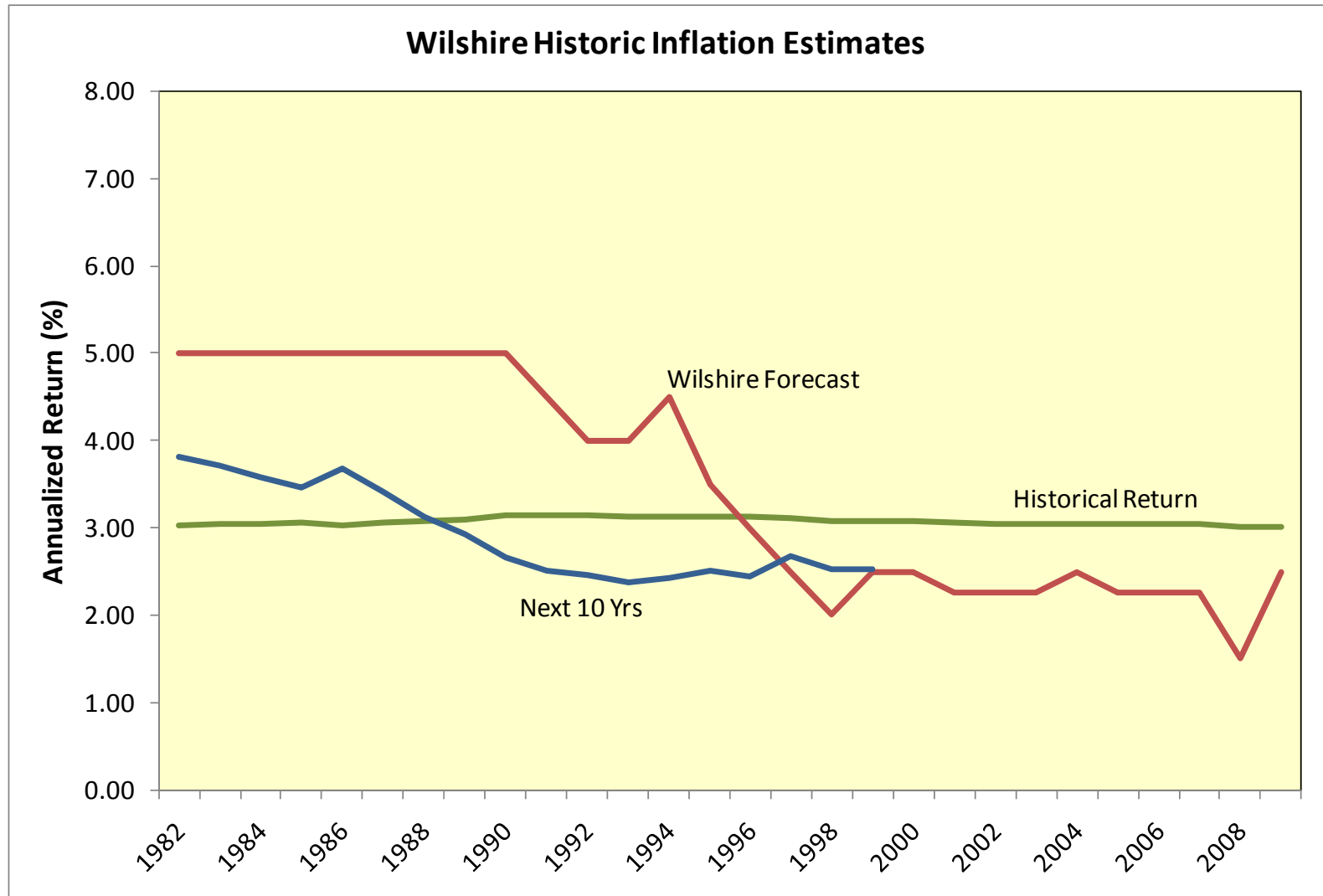
- Stock & bond forecasts are slightly below the 208-year actual return history
 - However, since the inflation forecast is 1.1% above the 208-year record, Wilshire's stock & bond forecasts relative to inflation are notably lower than historical spreads
 - Wilshire's stock versus bond forecast (3.3%) is comparable to the actual long-term historical relationship (3.1%)

Inflation

- **Market based inflation forecast**
 - TIPS are used to forecast inflation
 - Subtract TIPS YTM from nominal Treasury YTM with same maturity
- **As of 12/31/2009:**
 - 10-year Treasury yield = 3.84%
 - 10-year TIPS yield = 1.44%
 - Difference is TIPS 10-year “breakeven inflation rate” = 2.40%
- **Wilshire rounds the 2.40% “breakeven inflation rate” to a 2.50% long-term inflation forecast**

Inflation

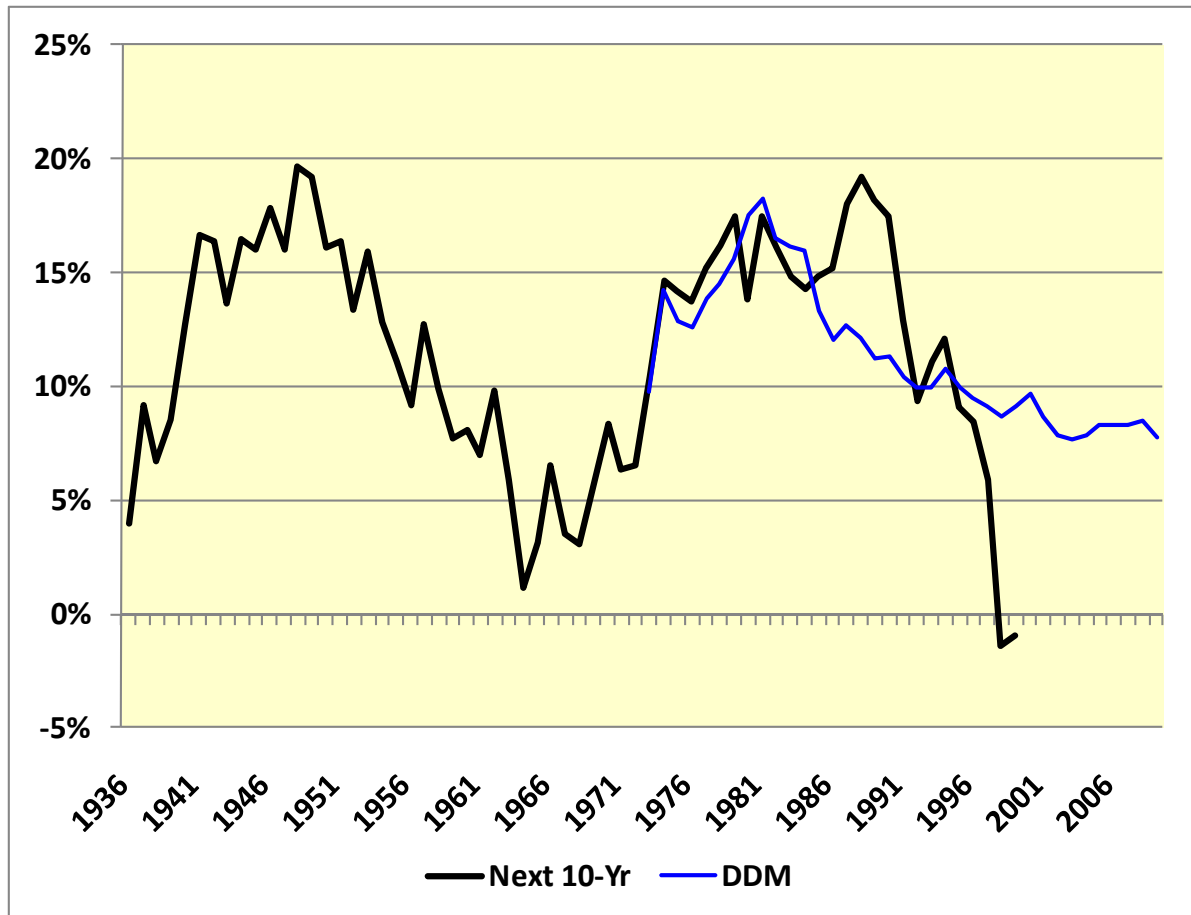
- Wilshire's Inflation Forecast and Historical CPI 1982-2009



Equity: US Stock - Model Forecasting

- **Dividend Discount Model (DDM) Accuracy**

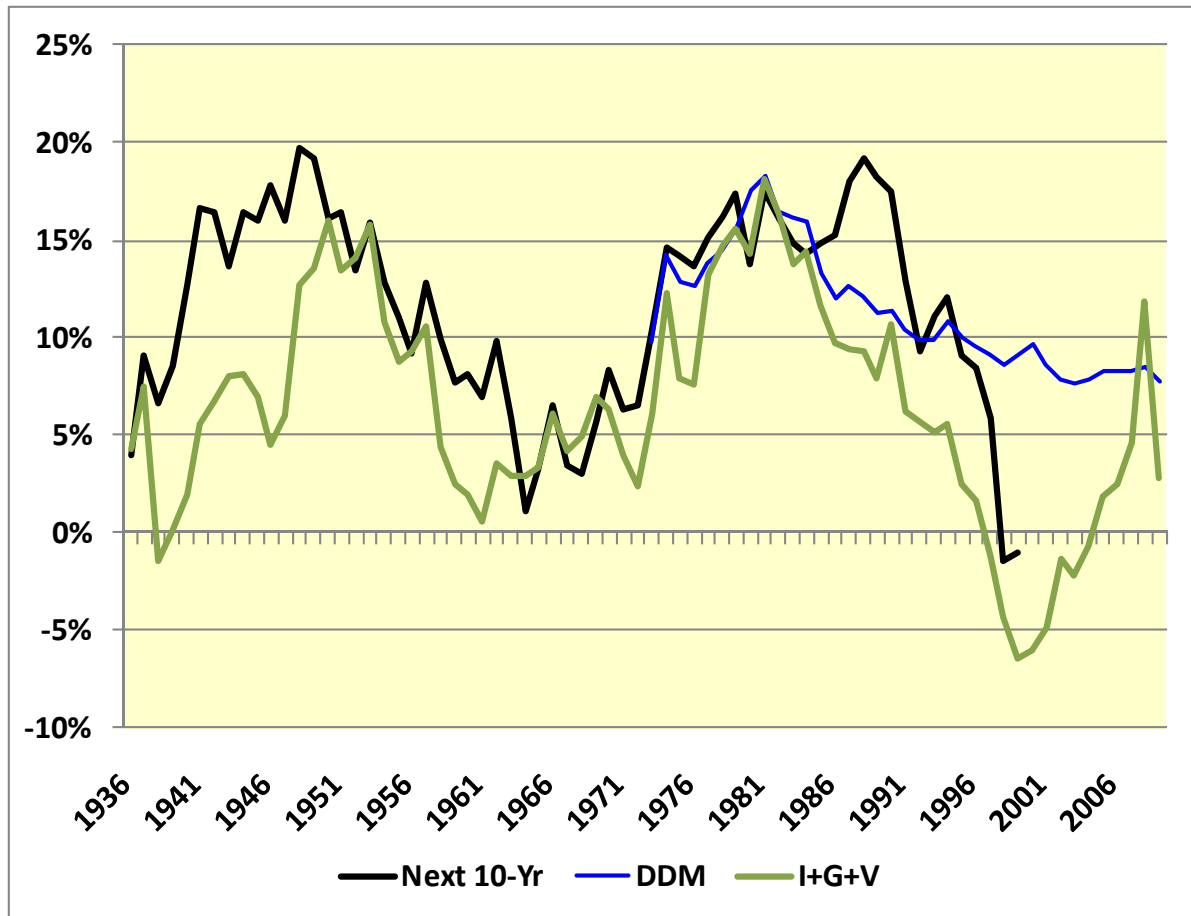
- Demonstrated historical reliability, but...
- Forecasting errors across valuation regimes



Source: Wilshire Compass

Equity: US Stock - Model Forecasting

- **DDM and Income + Growth + Valuation Model (IGV) Accuracy**
 - Both models missed the late-90's bubble, but...
 - Provide differing post-bubble signals



Source: Wilshire Compass

Equity: US Stock - Model Forecasting

- **IGV Model inputs are historical in nature**
 - I: Current dividend income
 - G: Historical dividend growth rate
 - V: Market price valuation in 10 years that results in historical average dividend yield
- **DDM and IGV Models Have Complimentary Inputs**
 - DDM is forward looking while IGV is historical
 - Using two signals can provide greater insight
- **Wilshire's 2010 forecast for US Stocks is 7.50%**
 - $\text{DDM} = 7.74\%$, $\text{IGV} = 2.85\%$
 - Using IGV signal to reduce DDM result by 25 basis points

Equity: Developed ex US Stocks

- Some argue that non-US stock returns should be higher than US stock returns
 - Believe foreign investments offer greater return opportunities
- Historical record does not support a higher return expectation for non-US stocks
 - Historical returns (through 2009):

	U.S. Dollar		Local Currency	
	Return	Risk	Return	Risk
S&P 500 Index	9.8 %	15.6 %	9.8 %	15.6 %
MSCI EAFE Index	9.5	17.1	7.6	14.7
Europe	9.9	17.3	9.2	15.5
Pacific	9.4	20.6	6.6	17.3

Source: Wilshire Compass

- Wilshire forecasts a 7.50% return for non-US developed stocks
 - Same expected return as US stocks

Equity: Emerging Market Stocks

- Many argue that emerging market returns should be higher than developed market returns
- Not fully supported by historical track record
 - MSCI EM vs. S&P 500 (5- & 10-year rolling):

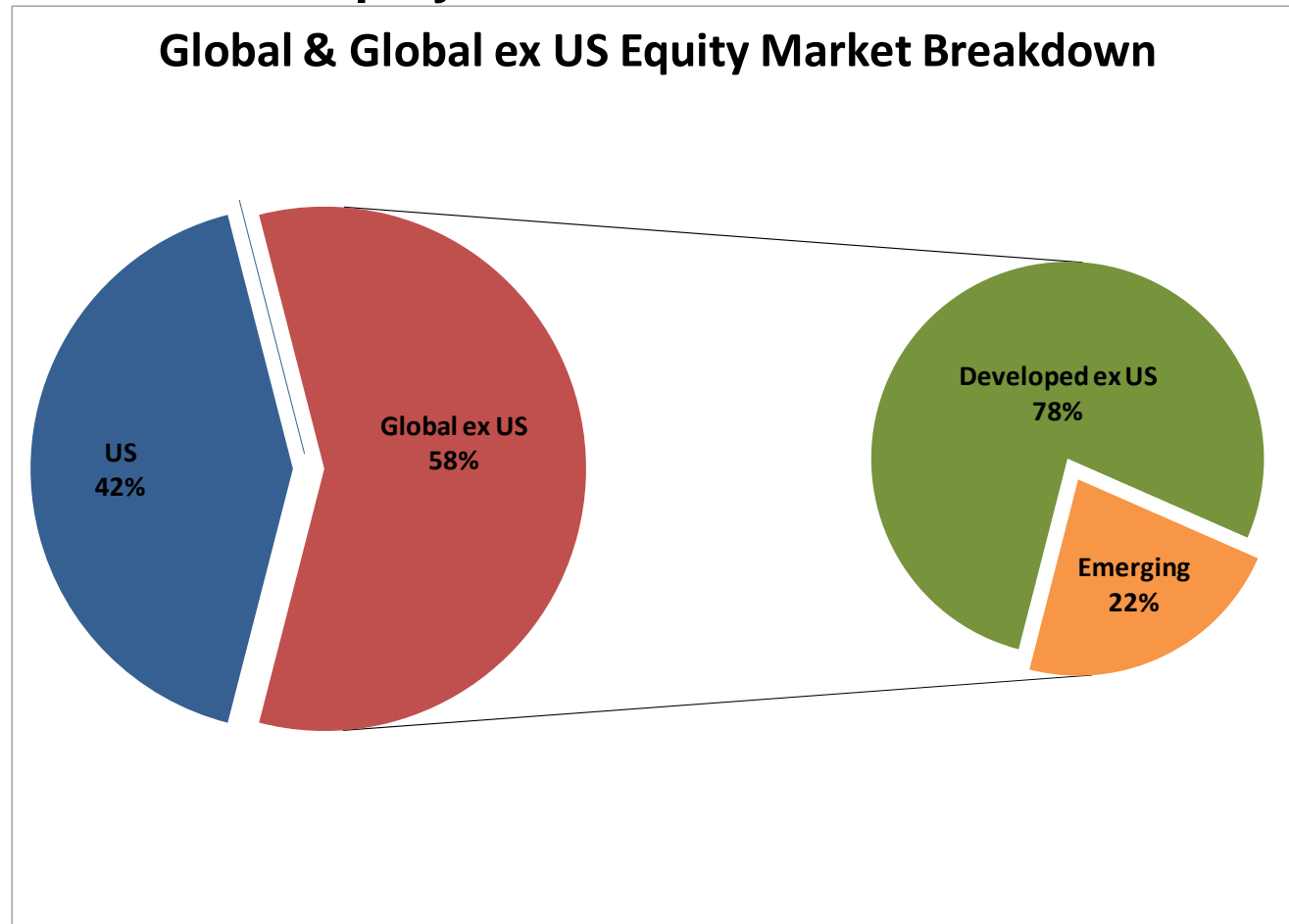


Source: Wilshire Compass

- Wilshire forecasts a 7.50% return for emerging market stocks
 - Same expected return for emerging markets as for US stocks

Equity: Global Market

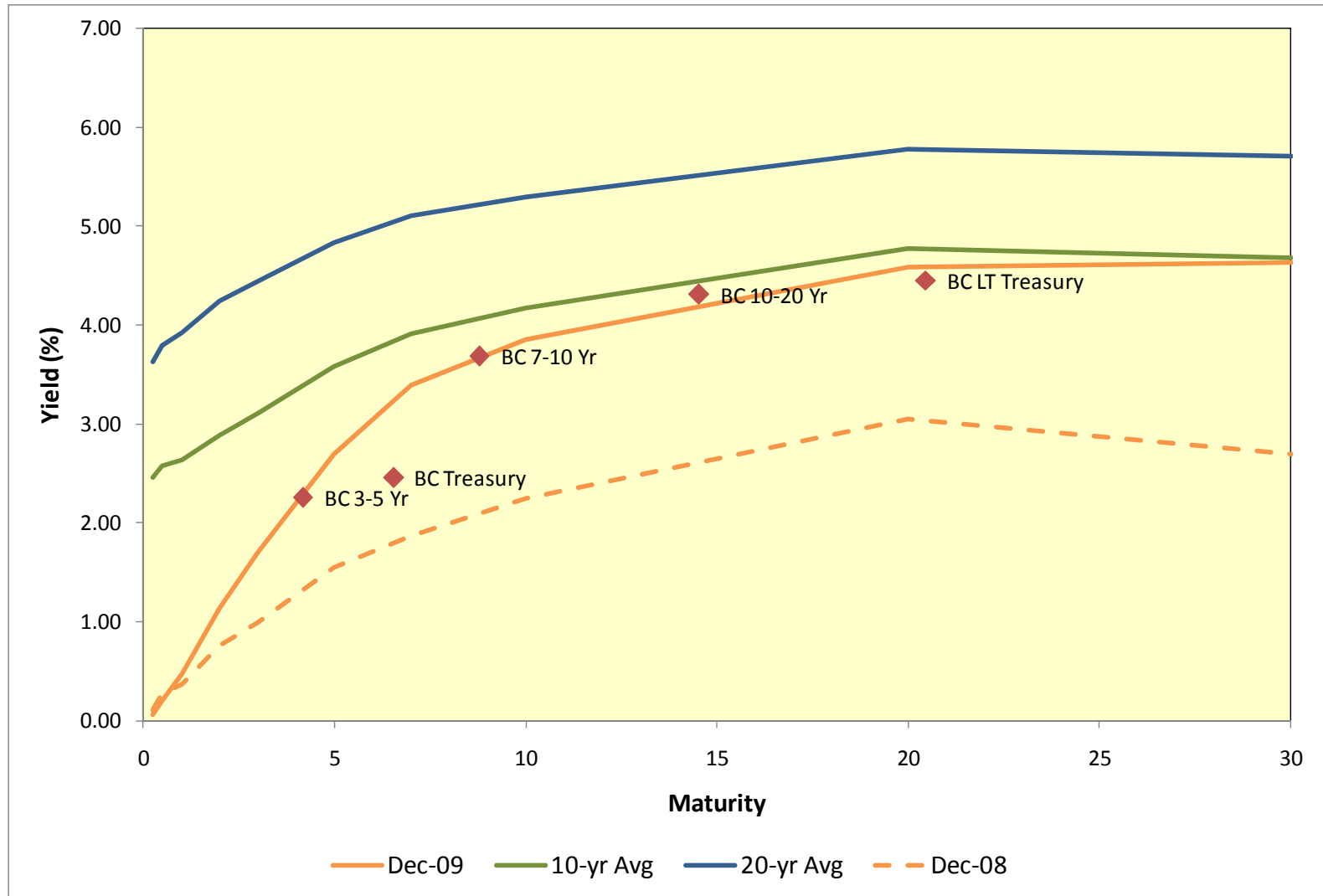
- **Market-weighted blend of Wilshire's equity return and risk assumptions results in a 7.75% return forecast for Global and Global ex US Equity**



Source: Wilshire AtlasSM

Fixed Income: US Interest Rate Environment

- Dec 2009 vs. Dec 2008, 10-Year, & 20-Year Averages



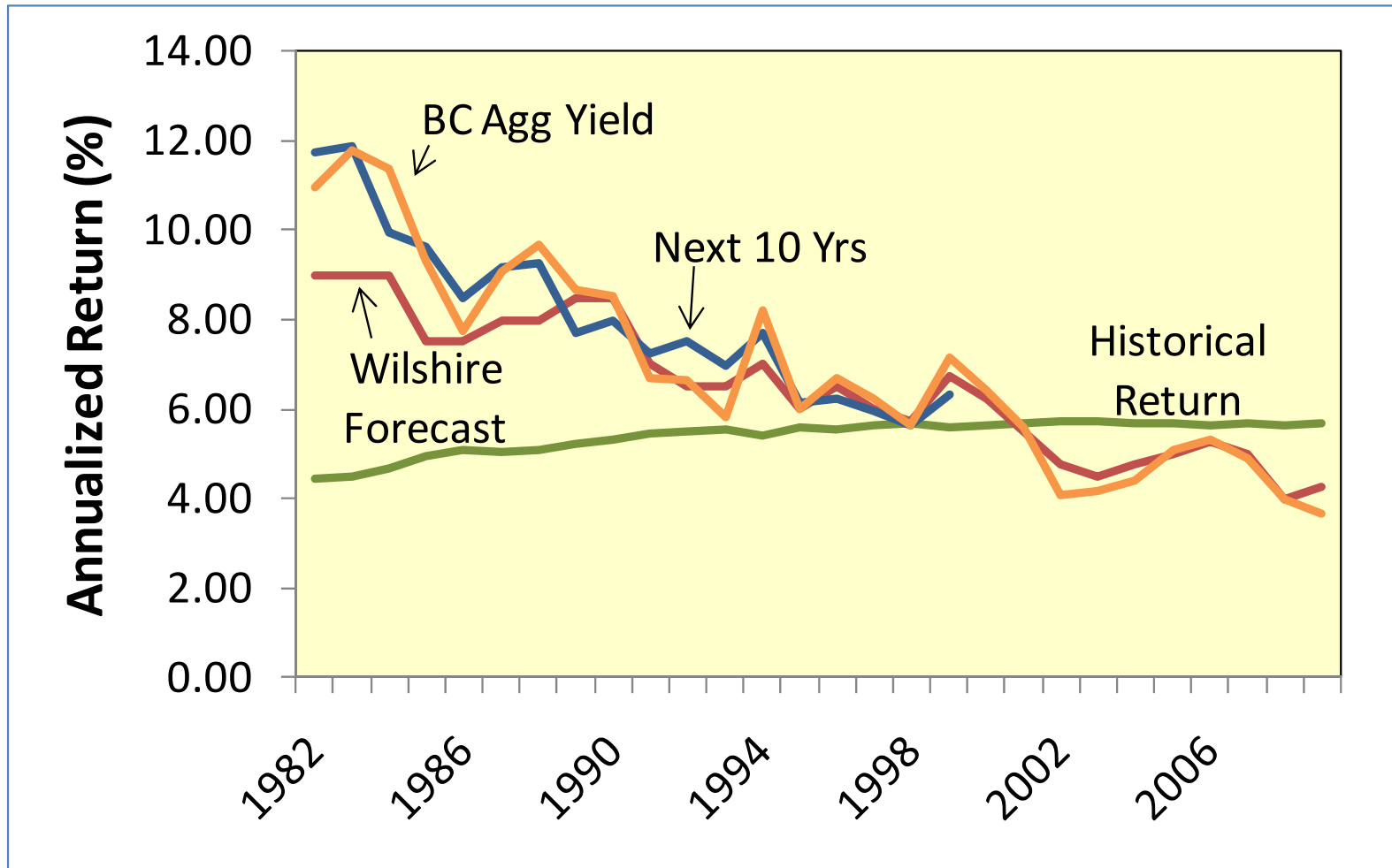
Source: Barclays Capital, U.S. Department of Treasury

Fixed Income: Core & Treasury Bond Assumptions

- **Fixed income forecasts reflect a moderate rising rate environment over the forecasting horizon**
 - Begins with our 2.50% inflation forecast and brings real yields in line with historical levels
- **Fixed income forecasts are aided by rising reinvestment rate**
 - US Core Bonds = 4.25% versus Dec 2009 yield of 3.68%
 - Treasuries = 3.00% versus Dec 2009 yield of 2.46%
 - TIPS = 3.75% versus Dec 2009 yield of 3.69% (Barclays Capital 7-10 Treasury Index)
- **Long term fixed income forecasts are hurt by decreased principal in rising rate environment**
 - US Long Term Core Bonds = 5.25% versus Dec 2009 yield of 5.46%
 - Long Term Treasuries = 4.25% versus Dec 2009 yield of 4.45%

Fixed Income: US Core Bonds

- **Wilshire Bond Forecast vs. Current Yield, Historical Return, & Actual 10-Year Return Following Forecast**



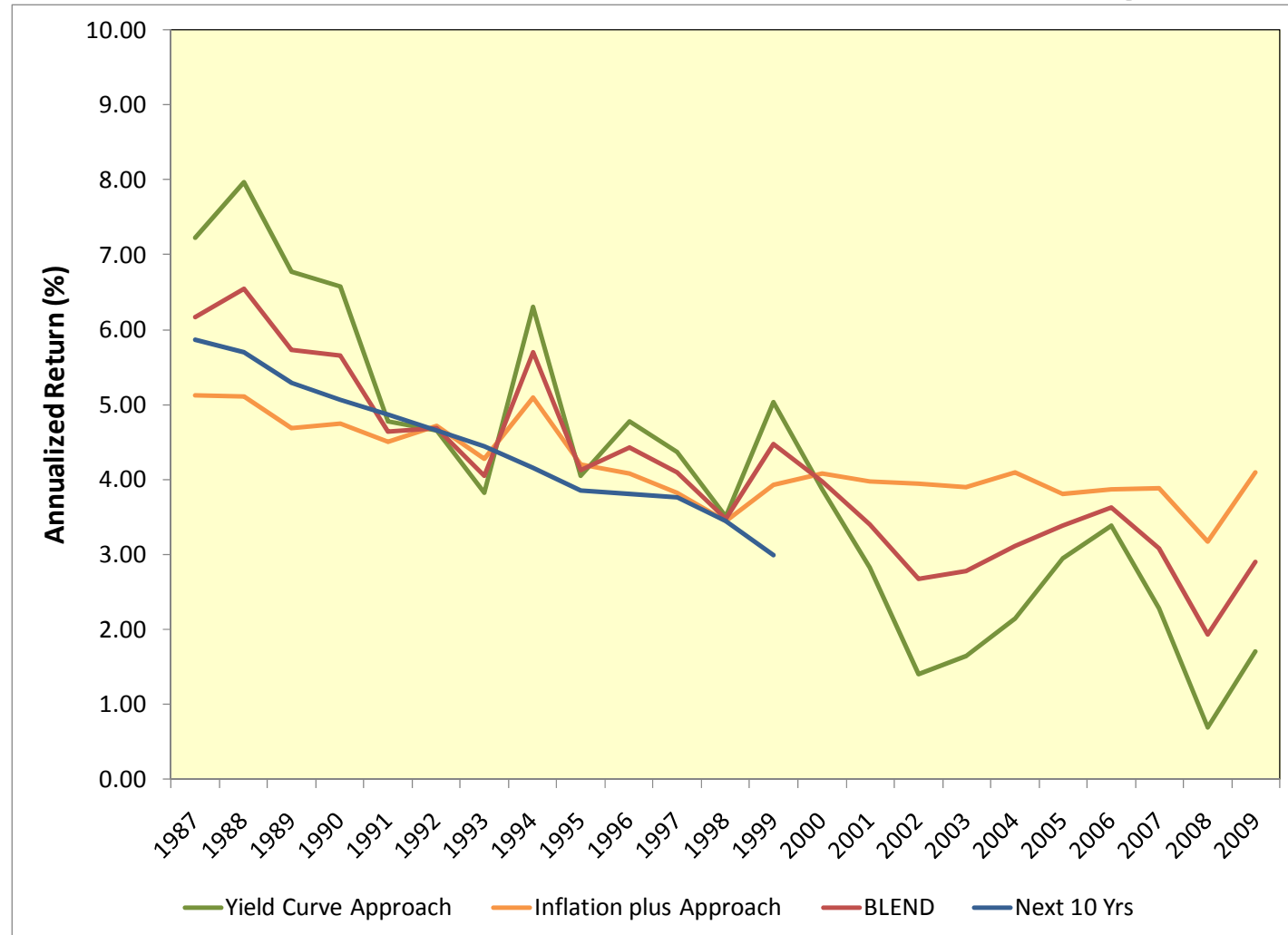
Source: Wilshire Compass

Fixed Income: Cash Equivalents

- Wilshire utilizes two approaches to forecast returns for cash equivalents
- Yield curve approach:
 - Treasury return forecast (3.10%) less average yield premium between short rates & long yields (1.39% past 20 years) = 1.71%
- Inflation plus approach:
 - Inflation forecast (2.50%) plus average real rate of return of Treasury Bills (1.59% past 50 years) = 4.09%
- Wilshire forecasts 3.00% return for cash equivalents

Fixed Income: Cash Equivalents

- Wilshire Cash Equivalent vs. Yield Curve Approach, Inflation Plus Approach, & Actual 10-Year Return Following Forecast



Source: Wilshire Compass

Fixed Income: Non-US Core Bonds

- Wilshire deducts 25 basis points from U.S. bond return forecast, due to:
 - Lower credit exposure and higher costs vs. the US bond market
- Historical returns (through 2009):

	U.S. Dollar		Local Currency	
	Return	Risk	Return	Risk
Core U.S. Bonds	8.1%	4.7%	8.1%	4.7%
Citigroup Non-U.S. Govt.	9.7%	11.6%	7.3%	4.1%

Source: Wilshire Compass

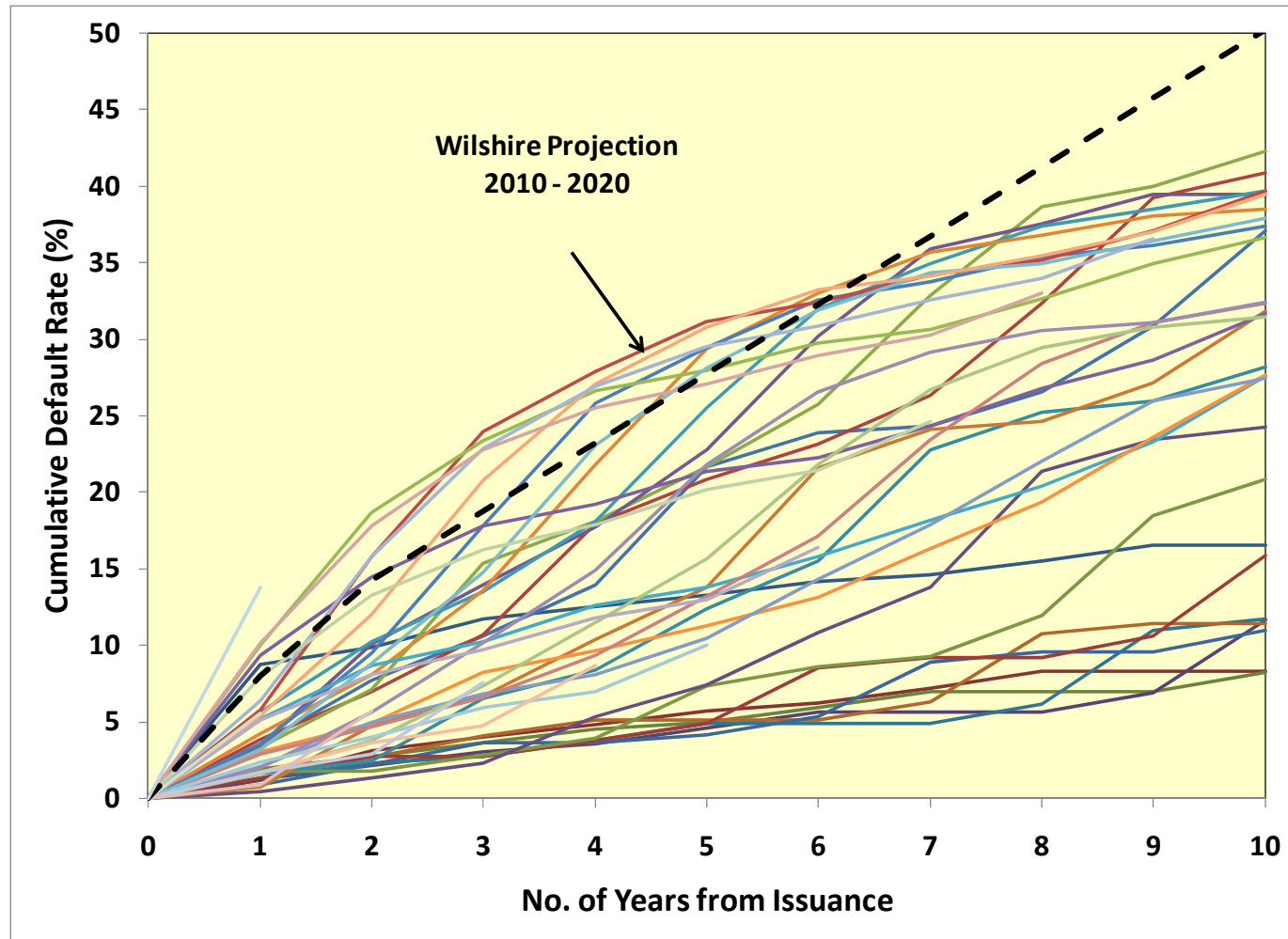
- Wilshire forecasts 4.00% return for non-US bonds
- Wilshire forecasts 3.90% return for hedged non-US bonds
 - 10 basis point deduction due to costs of currency hedging

Fixed Income: High Yield Bonds

- **Wilshire utilizes a high yield bond model to forecast returns**
 - Models cash flows over a long-term period (10 years)
 - Calculates return that equates projected cash flows to initial investment
 - Model accounts for credit yield spreads, defaults, recoveries & appreciation/depreciation of principal
- **Assumptions:**
 - Initial yield spread of 6.6%
 - Initial default rate of 8.0%, decreasing incrementally over the next three years to historical average of 4.5%
 - An initial recovery rate of 30%, increasing incrementally over a three-year period to a historical 40% long-run average
 - 10-year cumulative loss rate (defaults less recoveries) equal to 31.3%
- **Wilshire forecasts 6.00% return for high yield bonds**
- **Wilshire forecasts 5.75% return for emerging markets debt**

Fixed Income: High Yield Bonds

- **Historical Cumulative Default Paths from Issuance (Vintage Years 1970 – 2008)**



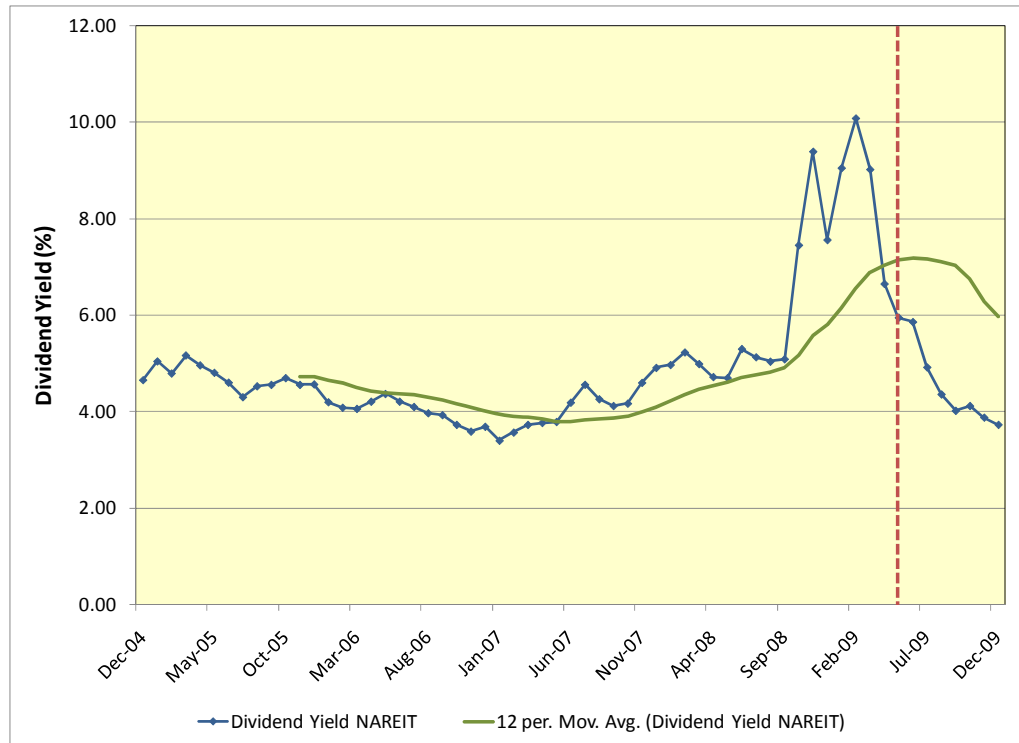
Source: Wilshire Consulting, Moody's Investor Services

Private Market Investments

- Expected returns based on Wilshire private market models as well as historical observation
 - 8.50% for buyouts
 - 10.75% for venture capital
 - 7.75% for mezzanine debt
 - 8.00% for distressed debt
- Wilshire forecasts 10.00% return for private markets portfolio
 - 70% buyouts / 20% venture capital / 5% Mezzanine. / 5% Distressed

Real Estate: US RE Securities (REITs)

- REIT assumption based on dividend yield + dividend growth
 - Volatile pricing/yield environment (market stabilization suggests 4.5% yield)



Source: FTSE Group and the National Association of Real Estate Investments Trust

- Expected dividend growth equals three-quarters of Wilshire's 2.50% inflation forecast = 1.9%
- Wilshire forecasts 6.50% return for US & non-US RE Securities (REITs)

Real Estate: Private RE Investments

- Expected returns based on Wilshire private real estate models (constructed from public market proxies and financing rates)
 - 6.00% for core
 - 8.75% for value-added
 - 11.00% for opportunistic
- Wilshire forecasts 7.35% return for private real estate basket portfolio
 - 70% core / 15% value-added / 15% opportunistic
- Private RE currently serves as a proxy for Infrastructure
 - Historical observations are lacking for a separate forecast
 - Both are primarily driven by owning and operating physical assets and are linked to long-term inflation

Commodities

- **Historical commodity returns (10-year rolling) versus Wilshire methodology**



Source: Wilshire Compass, Gorton & Rouwenhorst "Facts and Fantasies about Commodity Futures"

- **Wilshire forecasts 4.50% return for commodity futures**
 - **2.50% inflation expectation plus 2% premium**

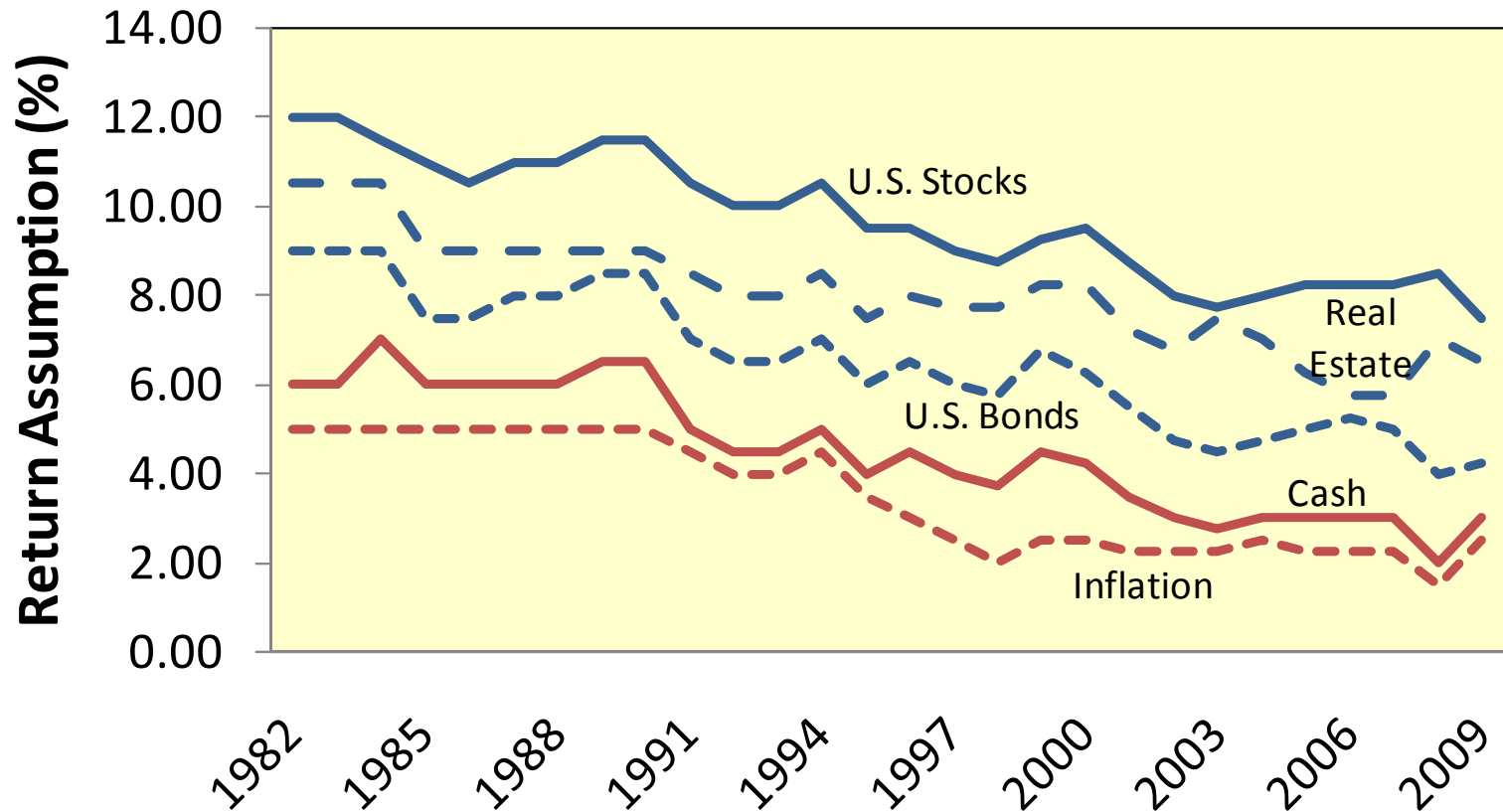
Timberland, Oil & Gas Partnerships

- Timberland return forecast is a function of biological growth and the market price for timber
- Wilshire's assumption is 7.50% for the timberland asset class
 - 5.00% as an estimate of the contribution of biological growth plus..
 - 2.50% increase in timber prices, reflecting the ability to fully capitalize inflation
- Oil & Gas Partnerships are analyzed from three perspectives:
 - MLP returns and spot market volatility
 - DDM forecast for MLP's
 - Yield plus inflation forecast
- Wilshire's Oil & Gas Partnerships assumption is 9.00% and considers signals derived from all three approaches

Real Asset Basket

- **A diversified approach to inflation-linked Investments**
 - 50/50 mix of equally risk-weighted public & private real asset baskets
- **Public real asset basket**
 - 50% TIPS
 - 25% Global RE Securities
 - 25% Commodity Futures
- **Private real asset basket**
 - 40% Private Real Estate (including infrastructure)
 - 35% Timberland
 - 25% Oil & Gas Partnerships
- **Real asset basket forecast = 6.75%**

Wilshire Forecasts Over Time



Source: Wilshire Consulting

Appendix

Wilshire 2010 Return, Risk & Correlation Matrix

	Equity						Fixed Income							Real Assets				
	Dev			Gbl		Prvt	LT						ex-US Bond (Hdg)	Real Estate			Real Asset Bskt	US CPI
	US Stock	ex-US Stock	Emg Stock	ex-US Stock	Gbl Stock		Cash	Core Bond	Core Bond	LT Treas	TIPS	High Yield		US RES	Gbl RES	Prvt RE	Cmdty	
Expected Return (%)	7.50	7.50	7.50	7.75	7.75	10.00	3.00	4.25	5.25	4.25	3.75	6.00	3.90	6.50	6.75	7.35	4.50	2.50
Expected Risk (%)	16.00	17.00	24.00	17.25	16.00	26.00	1.25	5.00	10.00	11.00	6.00	10.00	4.00	15.00	12.00	12.25	13.00	1.75
Cash Yield (%)	2.00	3.00	2.00	2.75	2.50	0.00	3.00	4.25	5.25	4.25	3.75	6.00	3.90	4.50	4.50	3.50	3.00	
Correlations:																		
US Stock	1.00																	
Dev ex-US Stock (USD)	0.80	1.00																
Emerging Mkt Stock	0.70	0.68	1.00															
Global ex-US Stock	0.83	0.96	0.83	1.00														
Global Stock	0.93	0.93	0.81	0.96	1.00													
Private Markets	0.75	0.65	0.63	0.69	0.75	1.00												
Cash Equivalents	-0.05	-0.09	-0.05	-0.08	-0.07	0.00	1.00											
Core Bond	0.29	0.12	0.00	0.09	0.18	0.32	0.20	1.00										
LT Core Bond	0.31	0.16	0.01	0.13	0.21	0.33	0.10	0.94	1.00									
LT Treasury	0.19	0.10	-0.05	0.06	0.12	0.24	0.10	0.92	0.96	1.00								
TIPS	-0.05	0.05	0.00	0.04	0.00	0.01	0.15	0.20	0.14	0.20	1.00							
High Yield Bond	0.55	0.40	0.50	0.46	0.52	0.34	-0.10	0.27	0.31	0.21	0.01	1.00						
Non-US Bond (Hdg)	0.16	0.26	-0.01	0.20	0.19	0.27	0.10	0.68	0.65	0.67	0.25	0.27	1.00					
US RE Securities	0.35	0.25	0.30	0.28	0.32	0.35	-0.05	0.15	0.16	0.10	0.15	0.45	0.00	1.00				
Global RE Securities	0.49	0.53	0.52	0.56	0.55	0.54	-0.03	0.14	0.16	0.09	0.17	0.49	0.06	0.86	1.00			
Private Real Estate	0.34	0.24	0.29	0.27	0.31	0.33	-0.03	0.24	0.24	0.19	0.16	0.48	0.08	0.82	0.72	1.00		
Commodities	0.00	0.20	0.24	0.23	0.14	0.05	-0.05	0.00	0.00	0.00	0.20	0.08	0.00	0.20	0.26	0.21	1.00	
Real Asset Basket	0.30	0.39	0.44	0.43	0.38	0.34	-0.03	0.19	0.18	0.15	0.43	0.40	0.11	0.66	0.71	0.69	0.56	1.00
Inflation (CPI)	-0.10	-0.15	-0.13	-0.15	-0.14	-0.10	0.10	-0.12	-0.12	-0.12	0.10	-0.08	-0.08	-0.10	-0.06	-0.07	0.20	0.11

* Inflation correlations are provided for informational purposes and do not represent forward-looking assumptions

Source: Wilshire Consulting

2010 Private Markets & Real Estate Matrices

	Buyouts	Venture Capital	Distressed Debt	Mezz Debt	Non-US Buyouts	Pvt Mkts Portfolio	US Stocks	Dev ex-US Stock	Emg Stock	Global ex-US Stock	Cash	Core Bond	High Yield Bond	US RES
Expected Return (%)	8.50	10.75	8.00	7.75	8.50	10.00	7.50	7.50	7.50	7.75	3.00	4.25	6.00	6.50
Expected Risk (%)	28.00	42.00	19.00	19.00	30.00	26.00	16.00	17.00	24.00	17.25	1.25	5.00	10.00	15.00
Correlations:														
Buyouts	1.00						0.70	0.55	0.55	0.59	0.00	0.40	0.30	0.35
Venture Capital	0.65	1.00					0.60	0.50	0.50	0.54	0.00	0.10	0.25	0.30
Distressed Debt	0.15	0.10	1.00				0.30	0.25	0.25	0.27	0.00	0.05	0.55	0.10
Mezzanine Debt	0.65	0.35	0.65	1.00			0.70	0.55	0.58	0.60	0.05	0.35	0.65	0.40
Non-US Buyouts	0.78	0.50	0.15	0.40	1.00		0.60	0.70	0.60	0.72	0.00	0.25	0.25	0.20
Pvt Mkts Portfolio	0.96	0.81	0.21	0.62	0.83	1.00	0.75	0.65	0.63	0.69	0.00	0.32	0.34	0.35

	US RES	Non-US RES	Global RES	Core	Value Added	Opport	Prvt RE Basket	US Stocks	Dev ex-US Stock	Emg Stock	Global ex-US Stock	Cash	Core Bond	High Yield Bond
----- Private RE -----														
Expected Return (%)	6.50	6.50	6.75	6.00	8.75	11.00	7.35	7.50	7.50	7.50	7.75	3.00	4.25	6.00
Expected Risk (%)	15.00	13.00	12.00	10.50	15.50	23.00	12.25	16.00	17.00	24.00	17.25	1.25	5.00	10.00
Correlations:														
US RE Securities	1.00							0.35	0.25	0.30	0.28	-0.05	0.15	0.45
Non-US RES	0.50	1.00						0.50	0.65	0.60	0.68	0.00	0.10	0.40
Global RES	0.86	0.87	1.00					0.49	0.53	0.52	0.56	-0.03	0.14	0.49
Core RE	0.90	0.45	0.77	1.00				0.30	0.20	0.25	0.23	-0.05	0.15	0.45
Value-Added RE	0.70	0.40	0.63	0.85	1.00			0.35	0.25	0.30	0.28	0.00	0.30	0.45
Opportunistic RE	0.55	0.35	0.52	0.70	0.95	1.00		0.35	0.25	0.30	0.28	0.00	0.35	0.45
Private RE Basket	0.82	0.44	0.72	0.96	0.96	0.88	1.00	0.34	0.24	0.29	0.27	-0.03	0.24	0.48

Source: Wilshire Consulting

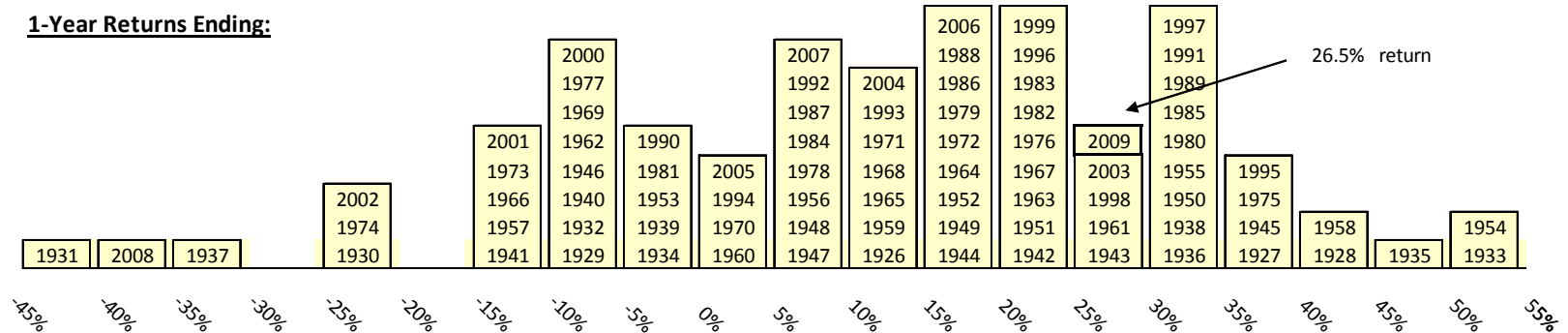
2010 Real Asset Basket Matrix

	<u>Public Real Assets</u>				<u>Private Real Assets</u>				
	Global RES	TIPS	Cmnty	Public RA Basket	Prvt RE	Timber	Oil & Gas Prtnshp	Private RA Basket	Real Asset Basket
Expected Return (%)	6.75	3.75	4.50	4.95	7.35	7.50	9.00	8.40	6.75
Expected Risk (%)	12.00	6.00	13.00	6.50	12.25	15.00	20.00	10.50	7.50
Correlations:									
Global REITS	1.00								
TIPS	0.17	1.00							
Commodities	0.26	0.20	1.00						
Public RA Basket	0.68	0.65	0.73	1.00					
Private RE Basket	0.72	0.16	0.21	0.52	1.00				
Timber	0.20	0.15	0.30	0.32	0.16	1.00			
Oil & Gas Prtnshp	0.35	0.15	0.25	0.36	0.30	0.25	1.00		
Priv RA Basket	0.60	0.22	0.36	0.57	0.68	0.69	0.73	1.00	
Real Asset Basket	0.71	0.43	0.56	0.82	0.69	0.61	0.66	0.94	1.00
US Stocks	0.49	-0.05	0.00	0.21	0.34	0.00	0.30	0.30	0.30
Dev ex-US Stocks	0.53	0.05	0.20	0.38	0.24	0.10	0.35	0.33	0.39
Emg Stock	0.52	0.00	0.24	0.37	0.29	0.15	0.40	0.40	0.44
Global ex-US Stock	0.56	0.04	0.22	0.40	0.27	0.12	0.39	0.37	0.43
Cash	-0.03	0.15	-0.05	0.03	-0.03	-0.05	-0.05	-0.06	-0.03
Core Bond	0.14	0.20	0.00	0.16	0.24	0.00	0.14	0.18	0.19
High Yield Bond	0.49	0.01	0.08	0.28	0.48	0.05	0.35	0.41	0.40

Source: Wilshire Consulting

Historical Stock Returns

Histogram of 1-Year Rolling Returns

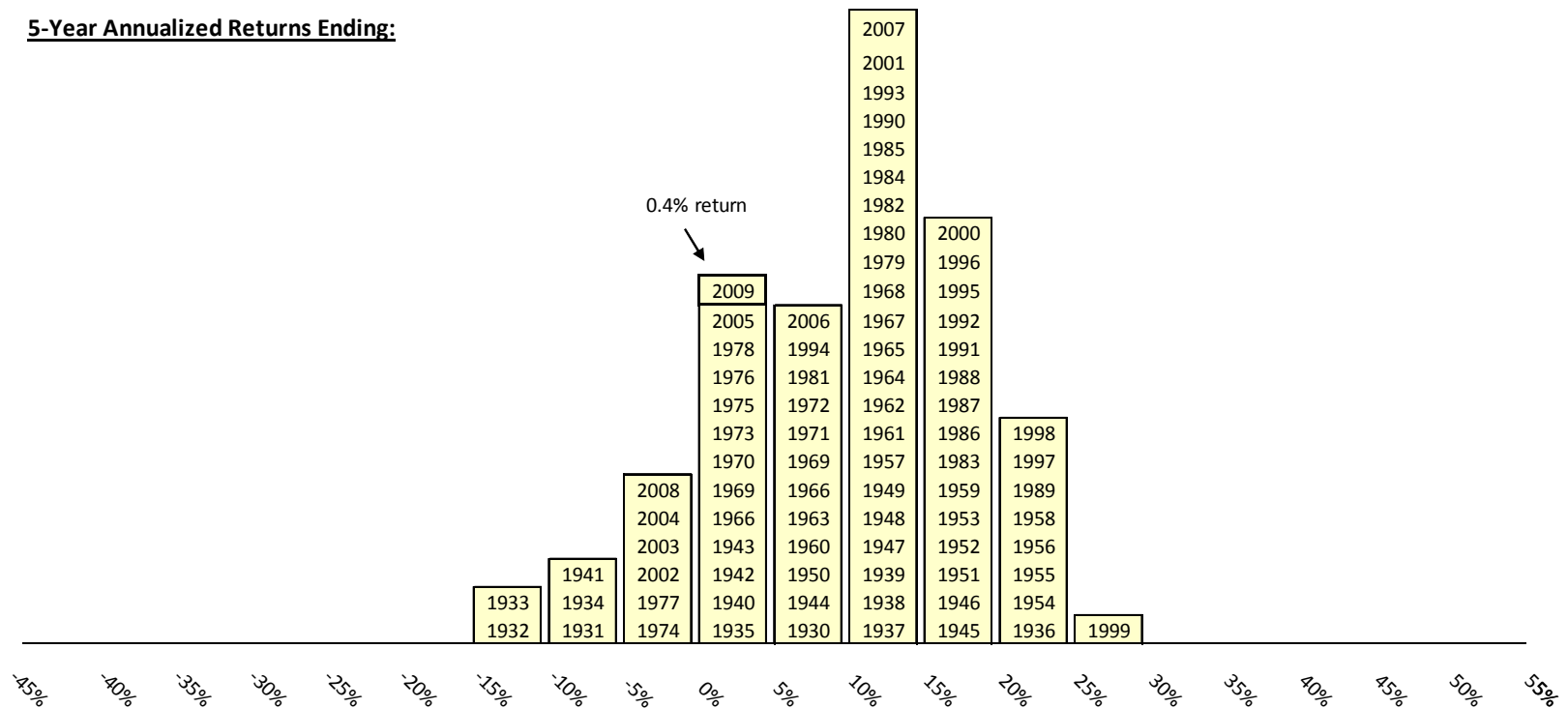


Source: Wilshire Compass

Historical Stock Returns

Histogram of 5-Year Rolling Returns

5-Year Annualized Returns Ending:

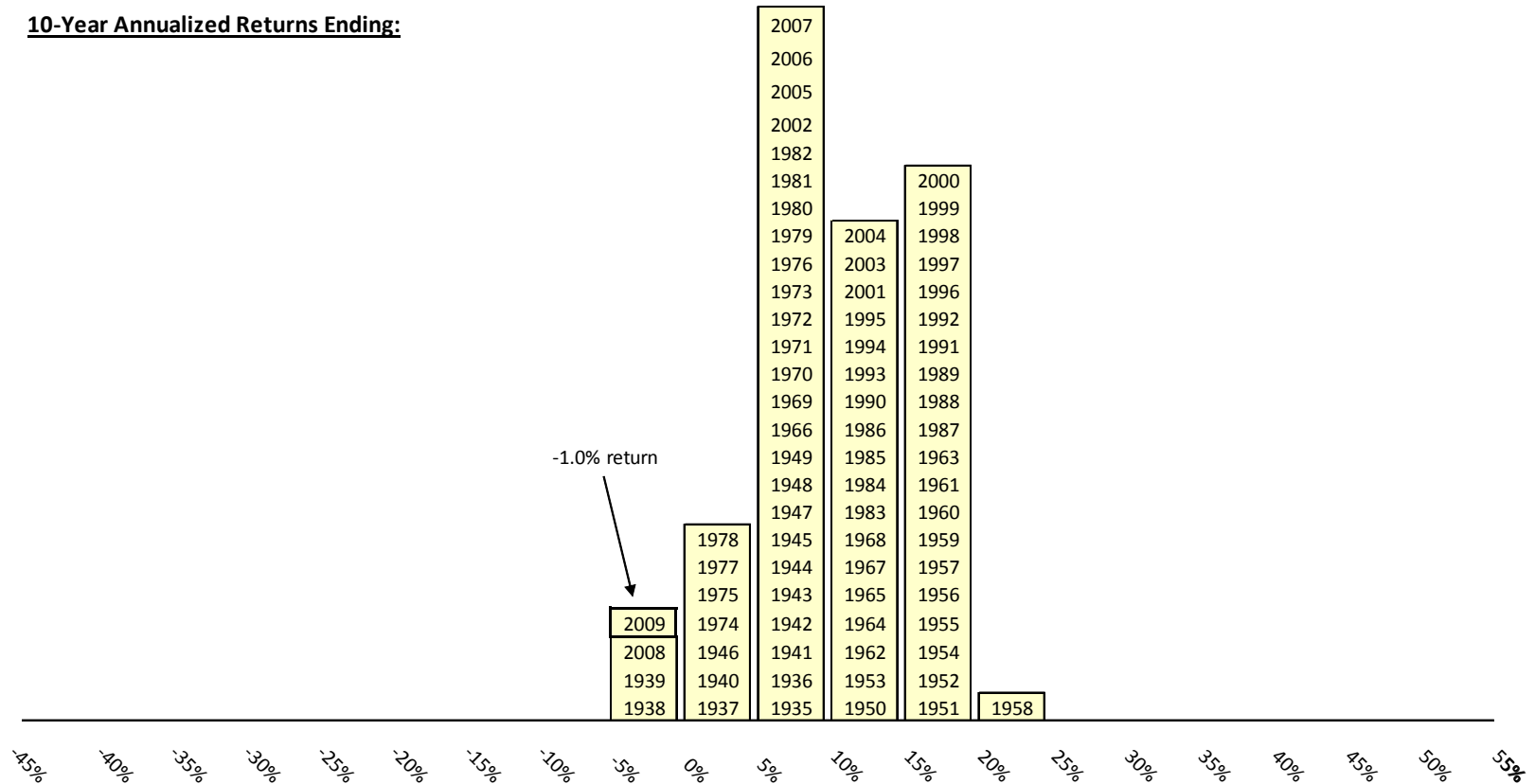


Source: Wilshire Compass

Historical Stock Returns

Histogram of 10-Year Rolling Returns

10-Year Annualized Returns Ending:



Source: Wilshire Compass

Important Information

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